User and maintenance manual for generating sets

R90C3

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1. Preface

1.1. General recommendations

Thank you for choosing an electrical generating set from our company.

This manual has been designed to help you operate and maintain your electrical generating set correctly.
The information contained in this manual is taken from technical data available at the time of print. In line with our policy of continually improving the quality of our products, this information may be amended without warning.

Read the safety instructions attentively in order to prevent any accidents, faults or damage. These instructions must always be followed.

You are likely to encounter several warning symbols in this manual.

Danger	This symbol indicates an immediate danger to human health and life in case of exposure. Failure to follow the corresponding advice entails serious consequences for human health and life in case of exposure.

Warning	This symbol draws attention to the potential risks to human health and life in case of exposure. Failure to follow the corresponding advice entails serious consequences for human health and life in case of exposure.

Important	This symbol indicates a dangerous situation if the warning is not heeded. Failure to follow the corresponding advice risks resulting in minor injury of personnel or damage to any other object in case of exposure.

In order to obtain optimum efficiency and the longest possible life for the electrical generating sets, maintenance operations must be carried out according to the periods indicated in the attached preventative maintenance tables. If the electrical generating set is used under dusty or unfavourable conditions, some of these periods will be shorter.

Ensure that all repairs and adjustments are carried out by personnel who have received appropriate training. Dealers have this qualification, and can answer all of your questions. They can also supply you with spare parts and other services.

The left and right sides can be seen from the back of the electrical generating set (the radiator is at the front).

Our electrical generating sets have been designed so that damaged or worn parts can be replaced by new or reconditioned parts thereby reducing the out of action period to a minimum.
For any replacement of parts, contact your nearest dealer for our company who will have the necessary equipment and can offer properly trained and informed staff to carry out maintenance, parts replacement and even total reconditioning of generating sets.

Contact your local dealer for the available repair manuals and to make the necessary arrangements for training personnel in implementation and maintenance.

Important	Some user and maintenance manuals for the engines fitted to generating sets cover control units and include the start-up and shutdown procedures for the engines. As the generating sets are fitted with control units that are specific to the generating sets, only the information that appears in the documentation for the generating sets' control units should be taken into consideration. In addition, according to the manufacturing criteria of the generating sets, some engines may be fitted with specific electrical wiring different to that described in the engine documentation.

1.2. Pictograms and their meanings

Safety notices are clearly mounted on the equipment to draw the operator's or maintenance technician's attention to the potential dangers and explain the action to be taken in the interest of safety. These notices are reproduced in this publication for ease of identification by the operator.
Replace any notice that is missing or illegible.

Warning: danger	Publications delivered with the generating set must be referred to	Warning: risk of explosion
Warning: risk of electric shock	Protective clothing must be worn	Naked flames and unprotected lights prohibited. No smoking
Warning: toxic materials	Your eyes and ears must be protected	Entry prohibited to non-authorised persons
Warning: pressurised fluids	Periodic maintenance must be carried out	Jet washing prohibited
Warning: high temperature, risk of burns	Battery level must be checked	Earth
Warning: rotating or moving parts (risk of getting caught in the machinery)	Lifting point required	Warning: corrosive product

Figure 1.1: Pictograms and their meanings

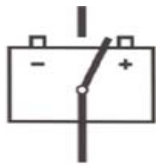
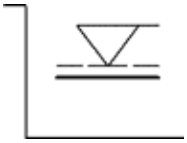
 Battery isolating switch	Fuel	External fuel connections
Inspection hatch	Retention container drainage	Fuel drainage
Oil drainage	Oil filling	Coolant filling
Coolant drainage	Forklift required for lifting	 Bulk tank level high
Fuel supply selection valves	During any operation on the batteries, wear protective glasses and protective clothing	Rinse any splashes of acid on the skin or in the eyes using clean water. Consult a doctor immediately. Contaminated clothes must be washed with water
① ②	① Important: refer to the documentation accompanying the generating set. ② Warning: emission of toxic exhaust gases. Do not use in a confined or badly ventilated area.	

Figure 1.1 (continued) : Pictograms and their meanings

1.3. Instructions and safety regulations

THESE SAFETY GUIDELINES ARE IMPORTANT

If you do not understand or have any questions about any point in this manual, contact your dealer who will explain it to you or give you a demonstration. A list of risks and precautionary measures to take follows. You should also refer to any local and national regulations that apply in accordance with your own jurisdiction.

KEEP THIS MANUAL

This manual contains important instructions which must be followed when installing or carrying out maintenance on a generating set or batteries.

1.3.1 General advice

Use

- ✓ The operating and safety instructions must be made known to operating personnel. They will be regularly updated.
- ✓ Read and understand the manuals provided with the generating set, pump unit or lighting column properly. The manufacturer's instructions must remain at the disposal of technicians, if possible in situ.
- ✓ The facility must be operated under the direct or indirect supervision of a person appointed by the operator, who is familiar with the operation of the facility, and the dangers and drawbacks of the products used or stored in the facility.
- ✓ Do not wear loose clothing, or get close to machines in operation. Note that the fans are not clearly visible when the engine is running.
- ✓ Warn personnel present to keep their distance during operation.
- ✓ Do not run the generating set, pump unit or lighting column without refitting the protective covers and closing all the access doors.
- ✓ Never let a child touch the generating set, pump unit or lighting column, even when shut down.
- ✓ Avoid operating the generating set, pump unit or lighting tower in the presence of animals (disturbance, scares, etc.).
- ✓ Engage the parking brake when the generating set or lighting tower on its trailer is installed on the operating site. When chocking the trailer on a slope; ensure that there is nobody in the path of the trailer.
- ✓ Never start the engine without an air filter or exhaust.
- ✓ Engine with turbocharger: never start the engine without fitting the air filter. The compressor wheel rotating inside the turbocharger may cause serious bodily injury. Foreign objects in the inlet pipe may cause mechanical damage.
- ✓ Engine with air preheating (starting components): never use a starting spray or any other similar starter assistance product. Upon contact with the starting component, an explosion may occur in the inlet tube, causing bodily injury.
- ✓ Do not touch the lighting column lights when they are switched on.

Maintenance

- ✓ Follow the maintenance table and its instructions.
- ✓ Always use tools in good condition which are suited to the work to be done. Ensure you have understood the instructions before beginning any operation.
- ✓ Goggles should be worn when carrying out maintenance operations and watches, bracelets etc. should be removed.
- ✓ Fit only original parts.
- ✓ Disconnect the battery and the pneumatic starter (if fitted) before undertaking any repairs, to prevent the engine from starting accidentally. Fit a panel over the controls to prevent any attempt to start.
- ✓ Only use the correct crankshaft turning techniques for turning the crankshaft manually. Do not try to turn the crankshaft by pulling it or levering the fan. This method may cause serious bodily or material damage, or damage the vanes of the fan, reducing the service life of the fan.
- ✓ Clean off any trace of oil, fuel or coolant using a clean cloth.
- ✓ Do not use a soapy solution containing either chlorine or ammonia, as these two chemicals prevent bubble formation.
- ✓ Never use petrol or other inflammable substances to clean the parts. Use only approved cleaning solvents.
- ✓ Do not use a high pressure cleaner for cleaning the engine and equipment. The radiator, hoses, electrical components, etc. may be damaged.
- ✓ Avoid accidental contact with parts at high temperatures (exhaust manifold, exhaust).
- ✓ Before any maintenance operation on a lighting column light, cut the electrical power supply and wait for the bulbs to cool down.

Consumables

- ✓ Observe regulations in force concerning use of fuel before using your generating set, pump unit or lighting tower.
- ✓ Under no circumstances use seawater or any other corrosive or electrolytic product in the cooling circuit.

Environment

- ✓ The operator must take the necessary measures to comply with the aesthetics of the site of use. The whole site must be maintained in a good state of cleanliness.
- ✓ The premises must be kept clean, and be regularly cleaned so as to avoid accumulation of dangerous materials or pollutants and dust, which could ignite or cause an explosion. The cleaning equipment must be suited to the risks posed by the products and dust.
- ✓ The presence of dangerous or combustible materials inside premises housing combustion devices shall be limited to the operating requirements.
- ✓ Facilities must be operated under the constant supervision of a qualified person, who must regularly check that the safety devices are operating correctly and ensure that the combustion devices have the correct fuel supply.
- ✓ Apart from the combustion devices, it is prohibited to use fire in any form. This restriction must be clearly displayed.

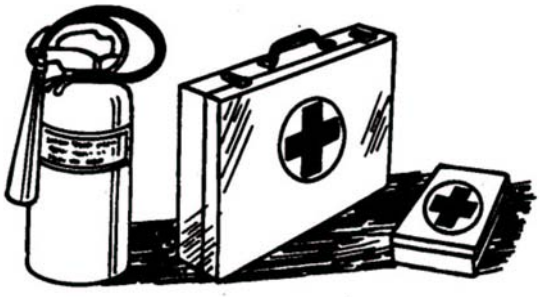
- ✓ Spreading of waste water, sludge and waste is prohibited.
- ✓ The fuels to be used must correspond to those featured in the declaration file and the specifications recommended by the combustion device manufacturer.
- ✓ The fuel is considered to remain in the same physical state as when it is introduced into the combustion chamber.
- ✓ Burning of waste in the open air is prohibited.
- ✓ Always protect your hands when checking for leaks. Pressurised liquids may penetrate body tissue and cause serious damage. Risk of blood contamination.
- ✓ Drain and dispose of engine oil in a specially provided container (fuel distributors can collect your used oil).
- ✓ Except by special agreement, once closed, the gas supply main unit must only be re-opened by the gas distributor. However, the user may access it under certain conditions. Check these for each site.

1.3.2 Risks related to exhaust gases and fuels

	The carbon monoxide present in exhaust gases may cause death if the concentration levels in the air breathed are too high. Always use generating sets, pump units or lighting towers in a well-ventilated place where gases cannot accumulate. In case of indoor use: ✓ Be sure to evacuate exhaust gases outdoors. ✓ Provide appropriate ventilation so that personnel present are not affected.
Danger	

- ✓ Observe the local regulations in force for generating sets, pump units or lighting towers, as well as local regulations for use of fuel (petrol, diesel fuel and gas) before using your generating set, pump unit or lighting tower.
- ✓ Fuel filling should be carried out when the engine is off (except for generating sets with an automatic filling system).
- ✓ Engine exhaust gases are toxic: do not run the generating set, pump unit or lighting column in unventilated premises. If installed in a ventilated room, additional requirements for fire and explosion protection must be observed.
- ✓ A leaking burnt gas exhaust may increase the sound level of the generating set, pump unit or lighting column. To check on its efficiency, regularly examine the burnt gas exhaust.
- ✓ Pipes must be replaced as soon as their condition demands it.

1.3.3 Risks related to toxic products

	The corrosion inhibitor contains alkali. Do not swallow it. This substance should not come into contact with the eyes. In the event of contact with the eyes, rinse immediately with plenty of water for at least 15 minutes. Avoid prolonged or repeated contact with the skin. In the event of contact with the skin, wash thoroughly with water and soap. CONSULT A DOCTOR IMMEDIATELY. KEEP THE PRODUCT OUT OF THE REACH OF CHILDREN**.** The anti-rust product is toxic and dangerous if absorbed. Avoid all contact with the skin and eyes. Read the instructions on the packaging.	Glycol is a toxic product and dangerous if absorbed. Avoid all contact with the skin and eyes. Read the instructions on the packaging. 
Warning		

- ✓ Caution: fuels and oils are dangerous to inhale. Ensure proper ventilation, and use a protective mask.
- ✓ Never expose the equipment to liquid splashes or rainfall, and do not place it on wet ground.
- ✓ The battery electrolyte is harmful to skin and especially eyes. If splashes get into eyes, rinse immediately with running water and/or a 10% diluted boric acid solution**.**
- ✓ Wear protective eyewear and strong base resistant gloves for handling the electrolyte.

1.3.4 Risk of fire, burns and explosion

Danger	The engine should not be operated in environments containing explosive products. As not all of the electrical and mechanical components are shielded, there is a risk of sparks forming.

- ✓ Make sure not to create sparks or flames, and not to smoke near the batteries, as the electrolyte gases are highly flammable (especially if the battery is charging). Their acid also poses a risk to the skin, and in particular to the eyes.
- ✓ Never cover the generating set, pump unit or lighting tower with any material during operation or just after shutdown (wait for the engine to cool).
- ✓ Do not touch hot parts such as the exhaust pipe, or put combustible materials on it.
- ✓ Keep all flammable or explosive materials (e.g. petrol, oil, cloth, etc.) out of the way when the set is running.
- ✓ Proper ventilation is required for your generating set, pump unit or lighting column to work properly. Without this ventilation, the engine would very quickly rise to an excessively high temperature, causing accidents or damage to the equipment and to surrounding property.
- ✓ Do not remove the radiator cap if the engine is hot and the coolant is pressurised, due to risks of burns.
- ✓ Depressurise the air, oil and cooling circuits before removing or disconnecting all the fittings, pipes or connected components. Watch out for the possible presence of pressure when disconnecting a device from a pressurised system. Do not try to find pressure leaks by hand. Oil at high pressure can cause bodily damage.
- ✓ Some preservative oils are flammable. Also, some are dangerous to inhale. Ensure proper ventilation. Use a protective mask.
- ✓ Hot oil causes burns. Avoid contact with hot oil. Check that the system is no longer pressurised before carrying out any procedures. Never start or run the engine with the oil filler cap off (oil may splash out).
- ✓ Never coat the generating set, pump unit or lighting column with a thin layer of oil to protect it from rust.
- ✓ Never top up the oil or coolant if the generating set, pump unit or lighting column is running, or if the engine is hot.
- ✓ A generating set can only operate when stationary, and cannot be installed on a vehicle or other mobile equipment, without a prior study taking into account the various specific features of using the generating set.

1.3.5 Risks related to electrical networks

- ✓ The electrical equipment supplied with the generating set complies with standard NF C15.100 (France), or with the standards of the countries in question.
- ✓ The earth connection must be installed in accordance with the standards in force in each country in question, and with the neutral system sold.
- ✓ Read the manufacturer's identification plate carefully. The values for voltage, power, current and frequency are shown. Check that these values match the supply use.
- ✓ Never accidentally touch stripped cables or loose connections.
- ✓ Never handle a generating set with wet hands or feet.
- ✓ Maintain electrical wires and connections in good condition. Using equipment in poor condition can lead to electrocution and damage to equipment.

- ✓ Always disconnect the power to the equipment or facility (generating set voltage, battery voltage and network voltage) before any operation.
- ✓ The electrical connections must be made in accordance with current standards and regulations in the country of use.
- ✓ Do not use faulty, poorly insulated or provisionally connected wires.
- ✓ Never reverse the positive and negative terminals on batteries when connecting them. This could cause severe damage to the electrical equipment. Follow the wiring diagram supplied by the manufacturer.
- ✓ The generating set should not be connected to any other power sources, such as the mains supply network. In specific cases where there is to be a connection to existing electrical networks, this must only be installed by a qualified electrician, who should take the operating differences of the equipment into account, according to whether the mains supply network or generating set is being used.
- ✓ Protection against electric shocks is ensured by an assembly of specific equipment. If this needs to be replaced, it should be by components with identical nominal values and specifications.

- ✓ If the protective plates (blanking covers) need to be removed to route cables, the protector (blanking cover) must be refitted when the operations are finished.
- ✓ Due to high mechanical stresses, use only strong flexible wiring with rubber sheathing, compliant with IEC 245-4, or equivalent wiring.

1.3.6 Dangers presented by electric currents (first aid)

First aid

In the event of an electric shock, shut off the power immediately and activate the emergency stop on the generating set or lighting column. If the voltage has not yet been cut off, move the victim out of contact with the live conductor as quickly as possible. Avoid direct contact both with the live conductor and the victim's body. Use a dry plank of wood, dry clothes or other non-conductive materials to move the victim away. The live wire may be cut with an axe. Take great care to avoid the electric arc that will be generated by this.

Begin emergency procedures

Resuscitation

If breathing has stopped, begin artificial respiration at once in the same place the accident took place unless the victim or operator's life could be endangered by this.
In the event of cardiac arrest, carry out cardiac massage.

1.3.7 Risks related to moving the set

To unload the generating sets, pump units or lighting columns from their transport support brackets under optimum safety and efficiency conditions, you must ensure that the following points are observed:

- ✓ The lifting machinery or equipment is suited to the work required, in good condition and with sufficient lifting capacity.
- ✓ The slings are positioned in the rings provided for this operation, the forklift arms are resting fully underneath all of the base frame cross-beams, or the lifting bars are inserted in the apertures provided for this purpose in the base to lift the entire generating set (according to models).
- ✓ For completely safe working conditions and to prevent damage to the components fitted on the upper edge of the set, pump unit or lighting column, the generating set, pump unit or lighting column must be lifted up with an adjustable boom. All the chains and cables must be parallel with each other, and as perpendicular as possible with the upper edge of the generating set, pump unit or lighting column.
- ✓ If other equipment fitted on the generating set, pump unit or lighting column alters its centre of gravity, special lifting devices may be necessary to maintain correct balance and completely safe working conditions.
- ✓ The ground must be able to withstand the load of the generating set, pump unit or lighting column and its lifting machinery without stress (otherwise, put down beams of sufficient strength in a stable configuration).
- ✓ Position the generating set, pump unit or lighting column as close as possible to its place of use or transport, in a clear space with free access.
- ✓ Never perform work on a generating set, pump unit or lighting tower just hanging from a lifting device.

1.3.8 Risks related to noise

	Dangerous noise **Risk of hearing loss**	
Important		

Prolonged exposure to a noise level above 80dB (A) can lead to permanent hearing damage**.**
Therefore, it is recommended that ear defenders are used when working in close proximity to a generating set which is in operation.

2. General description

2.1. Description

Overview

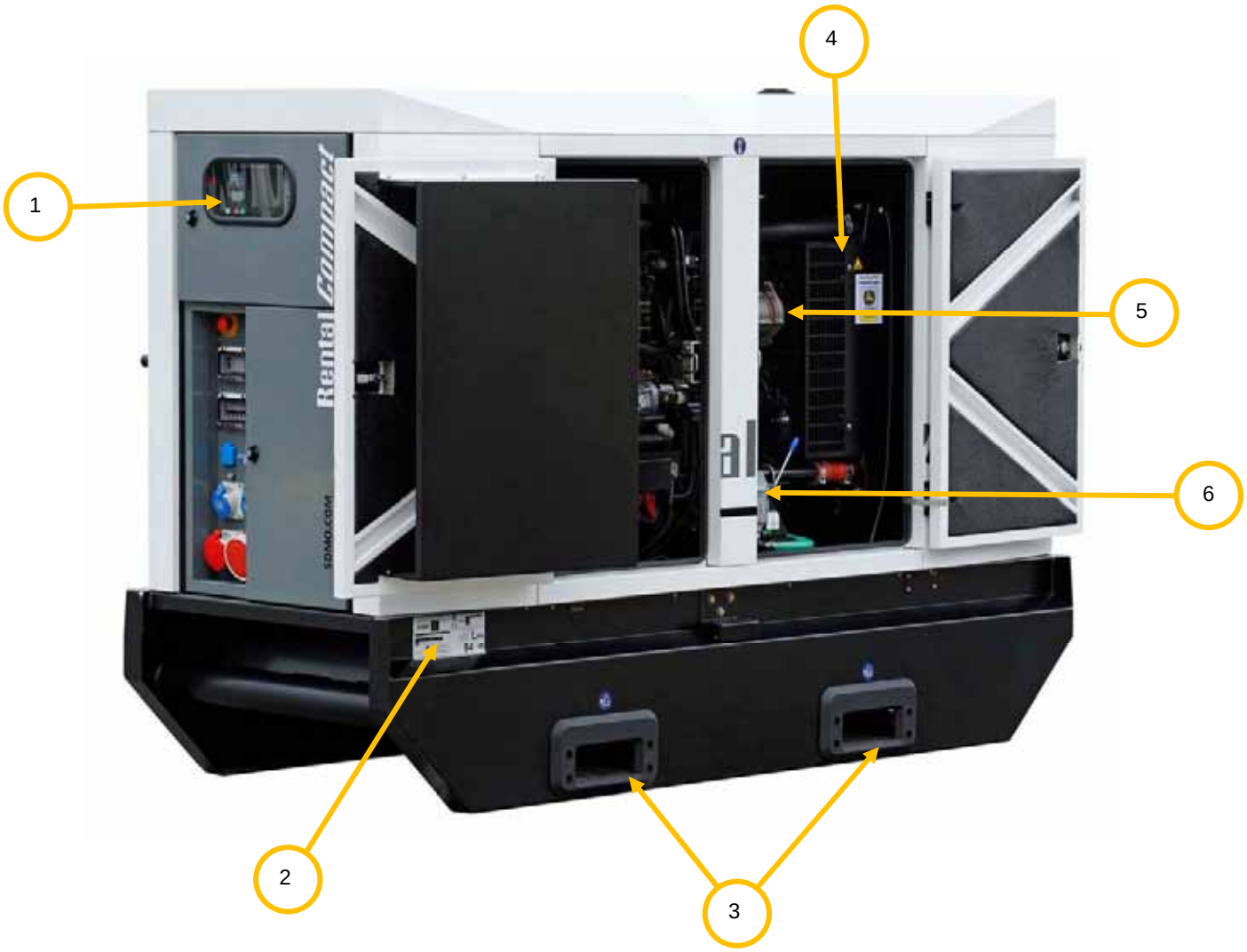


Figure 2.1.1: General description of the generating set

1	Control unit	4	Protective grille
2	Product information plate	5	Charging alternator
3	Forklift grooves	6	Oil drainage pump

Figure 2.1.2: General description of the generating set

1	Radiator access hatch	4	Air filtration
2	Coolant drainage	5	Alternator
3	Starter battery	6	Battery isolating switch

Control

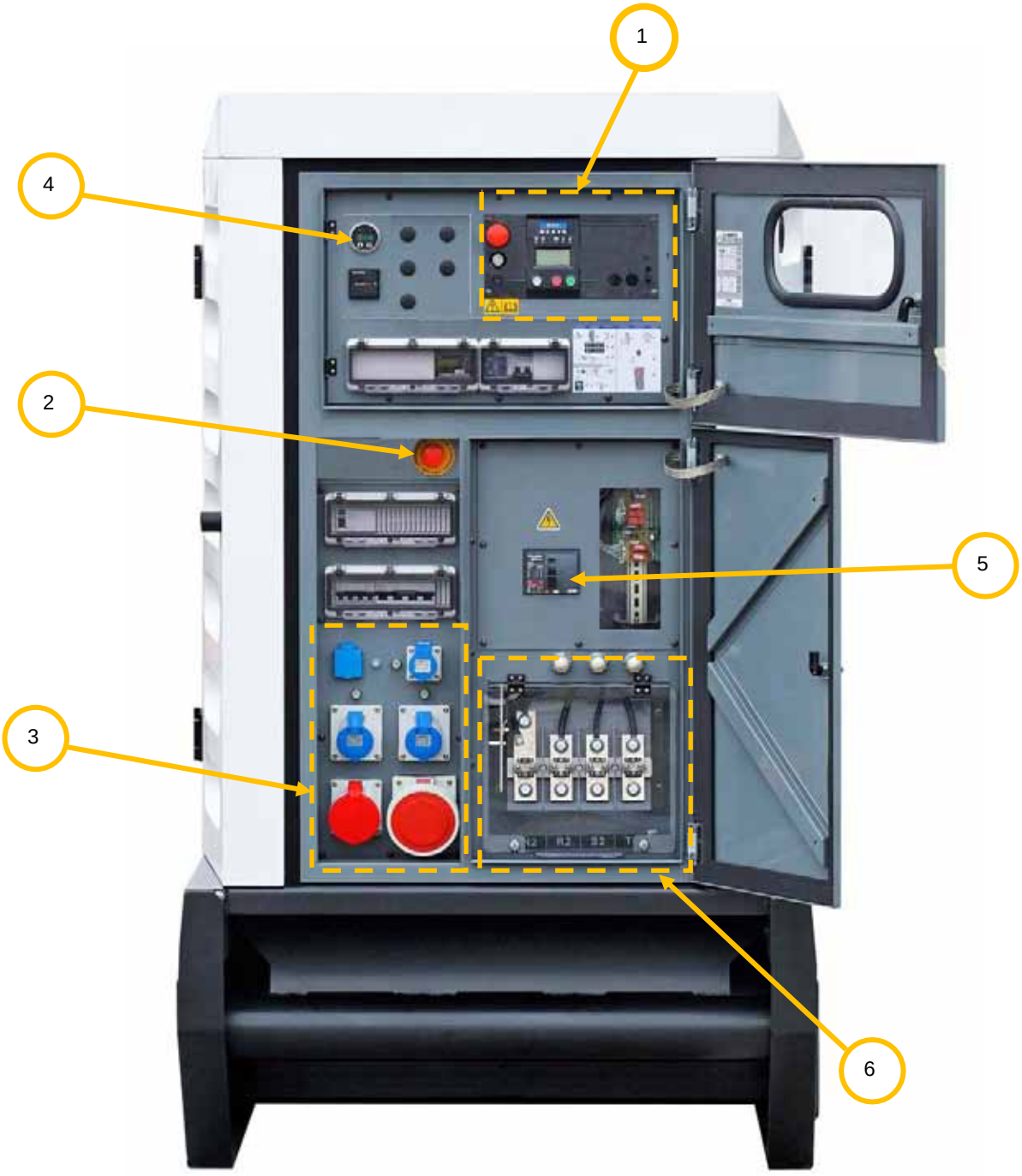


Figure 2.1.3: General description of the generating set

1	Control unit	4	Working hours counter
2	Emergency stop	5	Power circuit breaker
3	Socket control panel	6	Connection terminal block

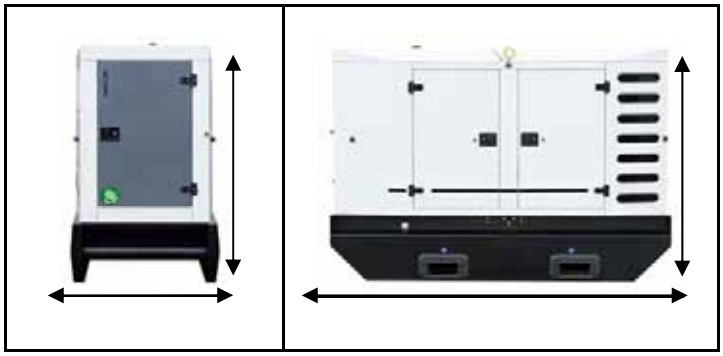
Note: Photo presented with the Nexys control unit.

2.2. Technical specifications

Range / Generating set type	RENTAL POWER / R90C3

Weights and Dimensions

Dimensions with high autonomy tank



Dimensions l x w x h:
2860mm x 1150mm x 1995mm

Hood:
M3129

Output

Voltage	Hz	Phase	Load factor	Max current (A)	Emergency power [1] kW / kVA	Prime power [2] kW / kVA
400/230	50	3	0.8	130	72 / 90	66 / 82

(1) ESP: Stand-by output available for emergency use under variable charge up to 200hrs per year as per ISO 8528-1, no overload available under these service conditions.

(2) PRP: Main output available continuously under variable load for an unlimited time period per year as per ISO 8528-1, an overload of 10% one hour every 12 hours is available, as per ISO 3046-1.

- Term of use :

Standard reference conditions ESP/PRP 40° / 40°, Air Intlet Temp, 1000m / 1000m mA.S.L. 60 % relative humidity.

Engine data	
Manufacturer / model	JOHN DEERE 4045HFS86
Type	Turbo air/air
Cylinder configuration	4 XL
Cubic capacity	4.48 L
Rotation speed	1500 Rpm
Max emergency/prime power at nominal speed	83 / 75.40 kW
Adjustment type	Electrical

Fuel consumption	
110 % (emergency power)	21.80 L/h
100 % main power	19.80 L/h

Fuel	
Fuel type	Diesel
High autonomy fuel tank	516 L

Lubrication	
Oil capacity	14.70 L
Min. Oil pressure	1.05 bar
Nominal oil pressure	4.00 bar
Oil consumption (100 % load)	0.05 L/h
Type of lubricant	Genlub

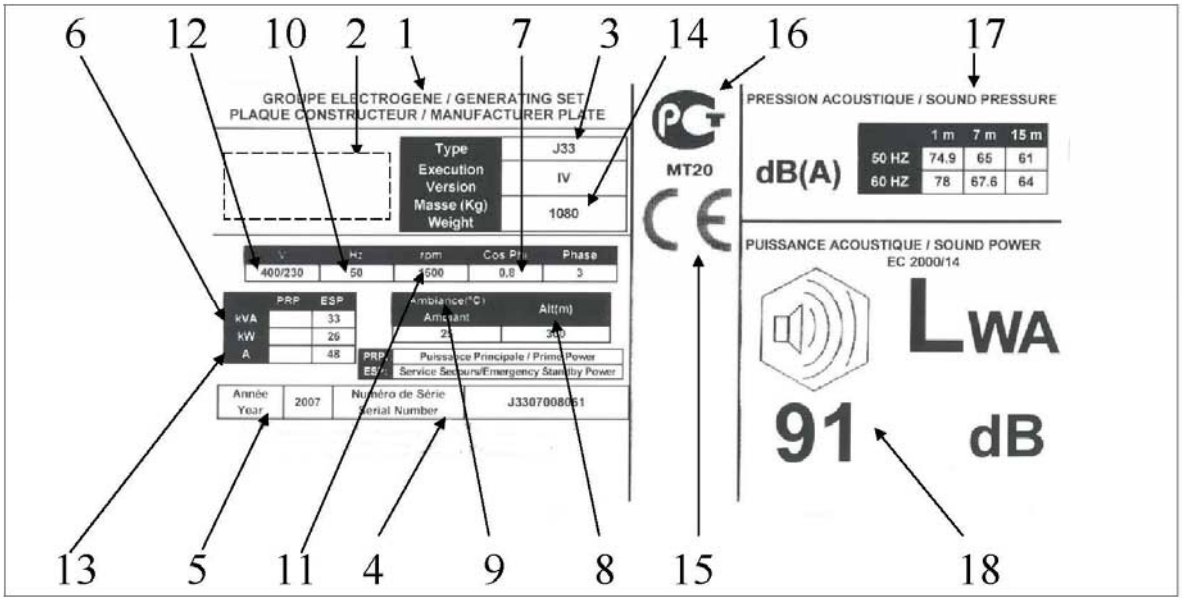
Cooling	
Fan power Max coolant temperature	110 °C
Refrigerant type	Gencool
Thermostat	82-95 °C

Alternator data	
● Compliant with NEMA MG21 standards, UTE NF C51 111, VDE 0530, BS 4999, IEC 34.1, CSA	● The alternator is protected against short circuits ● Vacuum impregnation, epoxy winding, IP23 protection rating
Type	LEROY SOMER LSA432L8
Number of phases	3
Power factor (cos Phi)	0.8
Number of poles	4
Excitation type	AREP
Insulation classe	H
Number of bearings	1
Coupling	Direct

Control unit(s)	
NEXYS 	<u>Standard specifications</u>: Frequency meter, Voltmeter, Ammeter <u>Alarms and faults</u>: Oil pressure, Coolant temperature, Fail to start, Overspeed, Alternator min/max, Fuel level low, Emergency shutdown <u>Engine parameters</u>: Working hours counter, Engine speed, Battery voltage, Fuel Level, Air Preheating
TELYS 	<u>Standard specifications</u>: Voltmeter, Ammeter, Frequency meter <u>Alarms and faults</u>: Oil pressure, Water temperature, Start failure, Overspeed, Alternator min/max, Battery voltage min/max, Emergency stop <u>Engine parameters</u>: Timer, Oil pressure, Water temperature, Fuel level, Engine speed, Battery voltage

2.3. Identifying sets

Generating sets and their components are identified by means of identification plates.
The precise rules for identifying each major component (engine, alternator etc.) are set out in each manufacturer's documentation contained in the appendices of this manual.



1 - Generating set 2 - Manufacturer name 3 - Model 4 - Serial number 5 - Year of manufacture 6 - Rated output (kVA and kW) according to the ISO 8528-1 standard PRP: main power ESP: emergency power 7 - Rated power factor 8 - Maximum altitude of the site above sea level (m) for the rated power	9 - Maximum ambient temperature for the rated power (°C) 10 - Rated frequency (Hz) 11 - Generating set rotation speed (RPM) 12- Rated voltage (V) 13 - Rated current (A) 14 - Weight (kg) 15 - CE marking 16 - Non CE standard marking (e.g.: GOSSTANDART) 17 - Sound pressure 18 - Sound power

Figure 2.2: Example of generating set identification plate

2.4. Fluid retention

Any outflow of the fluids contained in the generating sets (fuel, oil and coolant, or rainwater or condensation) will be collected in a retention container.
The containers have a capacity which allows 110% of the fluids contained in the generating set fitted with this option to be collected.

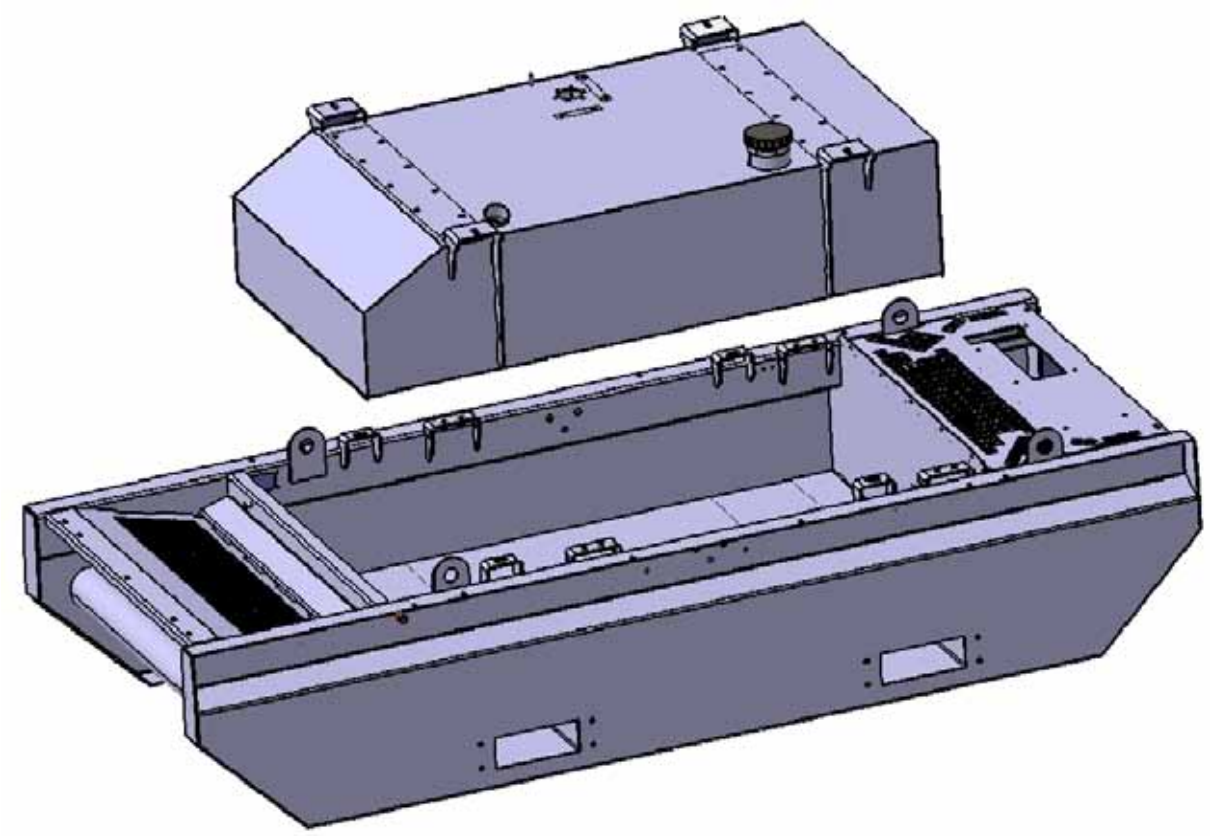


Diagram 2.3: Fluid retention container

The generating sets are fitted with a visual alarm warning when the upper limit of the retention container has been reached.

In all cases, the retention containers must be regularly checked to ensure they contain no fluid (fuel, oil and coolant, or rainwater or condensation). If necessary, drain the containers via the drain port.

- ✓ **Note**: Never allow these fluids to drain onto the ground; ensure they are collected in a designated container.

2.5. Fuel and consumables

All specifications (product features) are given in the engine maintenance manuals attached to this manual.

Fuels:
The specifications refer to European or international standards. Fuels complying with the standards indicated in the engine maintenance manuals can be used without any contraindications. Only these fuels may be used.

Consumables:
In addition to the specifications indicated in the engine maintenance manuals, the consumables mentioned in the section entitled "Specifications" are recommended.

2.5.1 Specifications

2.5.1.1. Oil grades

Engine		Oil	
Make	Type	Make	Type
John Deere	All	John Deere	John Deere PLUS-50
		GenPARTS	GENLUB TDX 15W40
MITSUBISHI	All	GenPARTS	GENLUB TDX 15W40
Volvo	All	GenPARTS	GENLUB TDX 15W40

GENLUB TDX 15W-40
Top-of-the-range lubricant recommended for diesel engines: for generating sets used under severe conditions.

USES:

- ✓ Particularly suited to more modern engines with or without turbochargers, *intercoolers*, or sophisticated injection systems (e.g. ***HEUI*****,** injector-pumps).
- ✓ **All types of use**: can cope with the most demanding applications.
- ✓ **Depolluted engines:** complies with EURO 2 and EURO 3 technology and can be used with all types of diesel fuel, especially ecological diesel with low sulphur content.

PERFORMANCE:

ACEA E3
API CH-4

- ✓ Meets level E3 of the specifications defined by European manufacturers in the ACEA standards 98 edition.

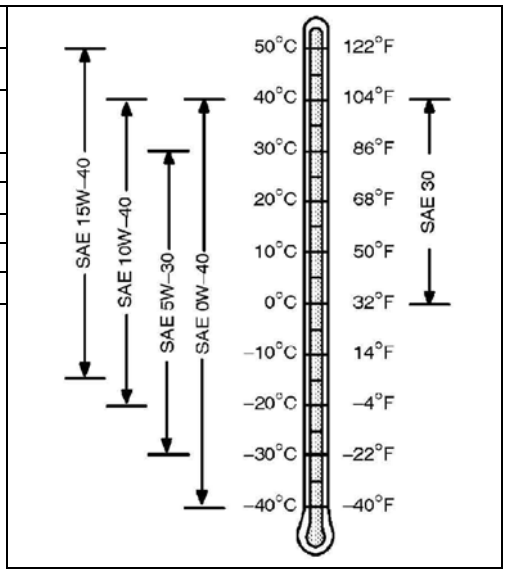
ADVANTAGES:

- ✓ **Less frequent oil services**: this product has been put to the test during thousands of hours of use on worksites under varying conditions, demonstrating its high quality.
- ✓ **Conformity with new environmental legislation**: adherence to new anti-pollution standards required for new EURO 2 and EURO 3 engines.

SPECIFICATIONS:

SAE Grade	**15W-40**	
Density at 15°C	0.883	
Cinematic viscosity at 40 °C Cinematic viscosity at 100 °C	105 14.1	mm2/s (cSt) mm2/s (cSt)
Viscosity index	140	
Dynamic viscosity at -15 °C	3000	mPa.s(cP)
Pour point	- 30	°C
Flash point	220	°C
Sulphated ash content	1.4	% weight

(Values given as examples only)



2.5.1.2. Specifications of coolants

Engine		Coolants	
Make	Type	Make	Type
John Deere	All	GenPARTS	GENCOOL PC -26°C
MITSUBISHI	All	Mitsubishi	LLC
		GenPARTS	GENCOOL PC -26°C
Volvo	All	GenPARTS	GENCOOL PC -26°C

GenCOOL PC -26
High-protection coolant, approved by manufacturers.
GenCOOL PC -26 is a ready-to-use, highly protective coolant which is produced from an antifreeze recommended by the majority of European manufacturers.

- It is made from antifreeze and G 48 inhibitors.
- It protects up to -26°C.
- It is free from nitrates, amines and phosphates.
- It is a clear, fluorescent orange liquid.

REFERENCES/APPROVALS (for the antifreeze):

HEAVY GOODS VEHICLE	LIGHTER VEHICLES
Approved by MTU, MERCEDES BENZ, MAN, KHD, GENERAL MOTORS Conforms with VOLVO, IVECO, VAN HOOL and STAYR TRUCK specifications	Approved by BMW, VOLKSWAGEN, MERCEDES, PORSCHE Conforms with VOLVO, OPEL, SEAT and SKODA specifications

Conforms with the NF R 15.601 standard

REINFORCED ANTI-CORROSION FEATURES:

- Protects **against high-temperature corrosion** by oxidisation of ethylene (cylinder head protection).
- Protects **against high-temperature cavitation** (top of cylinder and coolant pump protection).
- Non-corrosive for seals and hoses.
- Improves the **efficiency and longevity of the cooling system.**
- **GenCOOL PC -26** is especially recommended for engines fitted with aluminium or light alloy radiators.

HIGH TEMPERATURE SUITABILITY:

- Provides good conditions for thermal exchange.
- Perfect stability at high temperatures.
- **GenCOOL PC -26** is specially adapted for engines with high power densities.

LONG LASTING PROTECTION:

- High alkaline reserve/stability and longevity of corrosion inhibitors.
    - Maintains its technical properties during prolonged use at high temperatures (neutralisation of acids).
- Ensures maximum heat transfer without the build up of deposits in the cooling system.
- **GenCOOL PC -26** ensures optimum protection against overheating and corrosion in extreme conditions of vehicle use.

PACKAGING/STORAGE:

- **GenCOOL PC -26** is supplied in 210 l metallic barrels with smooth interior linings.
- It can be stored for 2 years in its original container and packaging.
- Avoid zinc coated containers.

RECOMMENDATIONS FOR USE:

- Compatible with the original fluid.
- It is recommended that the cooling system is completely drained when replacing the fluid.

SPECIFICATIONS	UNITS	SPECIFIED VALUES	TRIAL METHODS
Density at 20°C	kg/m^3	**1,059 +/- 3**	R 15-602-1
pH	pH	**7.5 to 8.5**	NF T 78-103
Alkalinity reserve	ml	**>=10**	NF T 78-101
Boiling point	°C	**105 +/- 2**	R 15-602-4
Freezing point:	°C	**-26 +/- 2**	NF T 78-102
Glassware corrosion : (test with antifreeze)	mg/test piece		R 15-602-7
- Copper		**+/- 2.6**	
- Weld		**+/- 0.5**	
- Brass		**+/- 2.3**	
- Steel		**+/- 1.6**	
- Cast iron		**+/- 0.8**	
- Cast aluminium		**+/- 1.0**	
Corrosion on warm plate (test with antifreeze)	mg/(cm²week)	**+/- 0.17**	R 15-602-8

3. Installation-Connections

3.1. Unloading

3.1.1 Safety during unloading

To unload electrical generating sets from their transport supports with optimum safety and efficiency, you must ensure that the following points are observed:

- The lifting machinery or equipment is suitable for the work required.
- The sling is correctly positioned in the central lifting eye or the lifting arms are correctly positioned in the fork-lift pockets intended for this purpose.
- The ground is able to bear the load of the generating set and its lifting machinery without stress (otherwise lay down stabilising beams of sufficient strength).
- The generating set is put down as close as possible to its place of use or transport, in a clear space with free access.

Example of equipment to be used:

- ✓ crane, slings, lifting beam, safety hook, shackles.
- ✓ Forklift truck.

3.1.2 Instructions for unloading

Hoisting

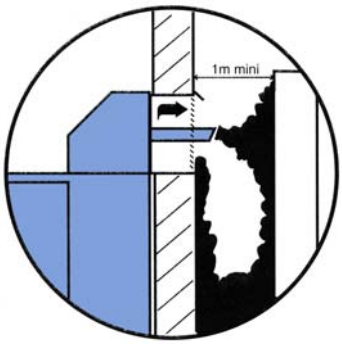
1. Attach the sling on the lifting equipment to the ring on the generating set (no. 1) provided for this purpose. Tension the slings slightly.
2. Check that the sling is correctly attached and the equipment is steady.
3. Lift the generating set carefully.
4. Direct the generating set towards the chosen location and stabilise it.
5. Carefully set down the equipment while continuing to position it.
6. Release the sling, then detach it.

Forklift truck:

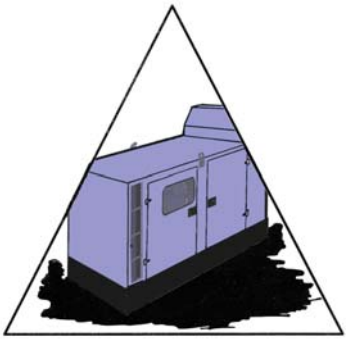
1. Position the arms of the forklift truck in the forklift pockets (no. 2).
2. Lift the equipment, handling it gently.
3. Set down the generating set in its unloading position.

3.2. Choice of location

This shall be determined according to the application. There are no strict rules governing the choice of location, other than the proximity of the electrical supply panel and the disturbance caused by the noise. However, it is important to take into account the fuel supply, the evacuation of burnt gases, the direction of these gases and evacuation noises.
The choice of location will therefore be the result of a carefully considered compromise!
Examples of problems that may be encountered:

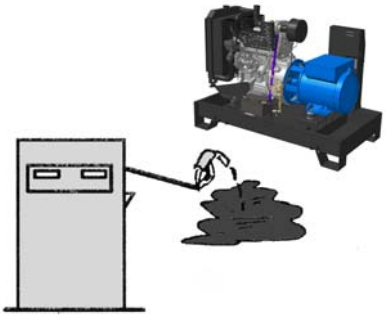


Incorrect ventilation and exhaust

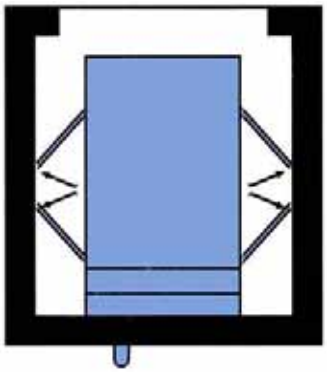


Building or terrain too rough.
Generating set incorrectly seated

Reduced access



Impossible to fill with fuel



Impossible to open enclosure doors

Figure 3.1: Examples of problems that may be encountered

Warning	**Ensure that the generating set is placed on a flat surface.**

3.3. Moving the genset

Whenever the generating set is moved, the appropriate equipment must be used (sling, forklift, etc.) and you must know the parts of the generating set which enable it to be moved (see below).

❶ Central lifting ring

❷ Forklift pockets

❸ Drawbars

3.4. Connections

3.4.1 Connections - general information

As with low voltage electrical installations, use and maintenance is governed by standard NFC 15.100 (France) or by the standards in the relevant country, based on international standard IEC 60364-6-61.
They must also adhere to the regulations in the NFC 15.401 application guide (France) or to the regulations and standards in the relevant country.

3.4.2 Power cables

These can be unipolar or multipolar according to the power of the generating set.
Power cables should preferably be installed in ducts or on a cable tray for this purpose.
The cable cross-section and number of cables should be determined according to the cable type and the current standards to be observed in the country of installation. The choice of conductors must comply with international standard IEC 30364-5-52.

Three phase - Calculation hypothesis
Fitting method = wiring in cable runs or non perforated trays.
Permissible voltage drop = 5%
Multiconductors or single conductor joined when precision 4X…(1)
Cable type PVC 70°C (e.g. H07RNF).
Ambient temperature = 30°C.

Circuit breaker calibre (A)	Cable sizes		
	0 - 50m	51 - 100m	101 - 150m
	mm²/AWG	mm²/AWG	mm²/AWG
10	1.5 / 14	2.5 / 12	4 / 10
16	2.5 / 12	4 / 10	6 / 9
20	2.5 / 12	4 / 10	6 / 9
25	4 / 10	6 / 9	10 / 7
32	6 / 9	6 / 9	10 / 7
40	10 / 7	10 / 7	16 / 5
50	10 / 7	10 / 7	16 / 5
63	16 / 5	16 / 5	25 / 3
80	25 / 3	25 / 3	35 / 2
100	35 / 2	35 / 2	4X(1X50) / 0
125	(1) 4X(1X50) / 0	4X(1X50) / 0	4X(1X70) / 2/0
160	(1) 4X(1X70) / 2/0	4X(1X70) / 2/0	4X(1X95) / 4/0
250	(1) 4X(1X95) / 4/0	4X(1X150) / 2350MCM	4X(1X150) / 2350MCM
400	(1) 4X(1X185) / 0400MCM	4X(1X185) / 0400MCM	4X(1X185) / 0400MCM
630	(1) 4X(2X1X150) / 2x 2350MCM	4X(2X1X150) / 2x 2350MCM	4X(2X1X150) / 2x 2350MCM

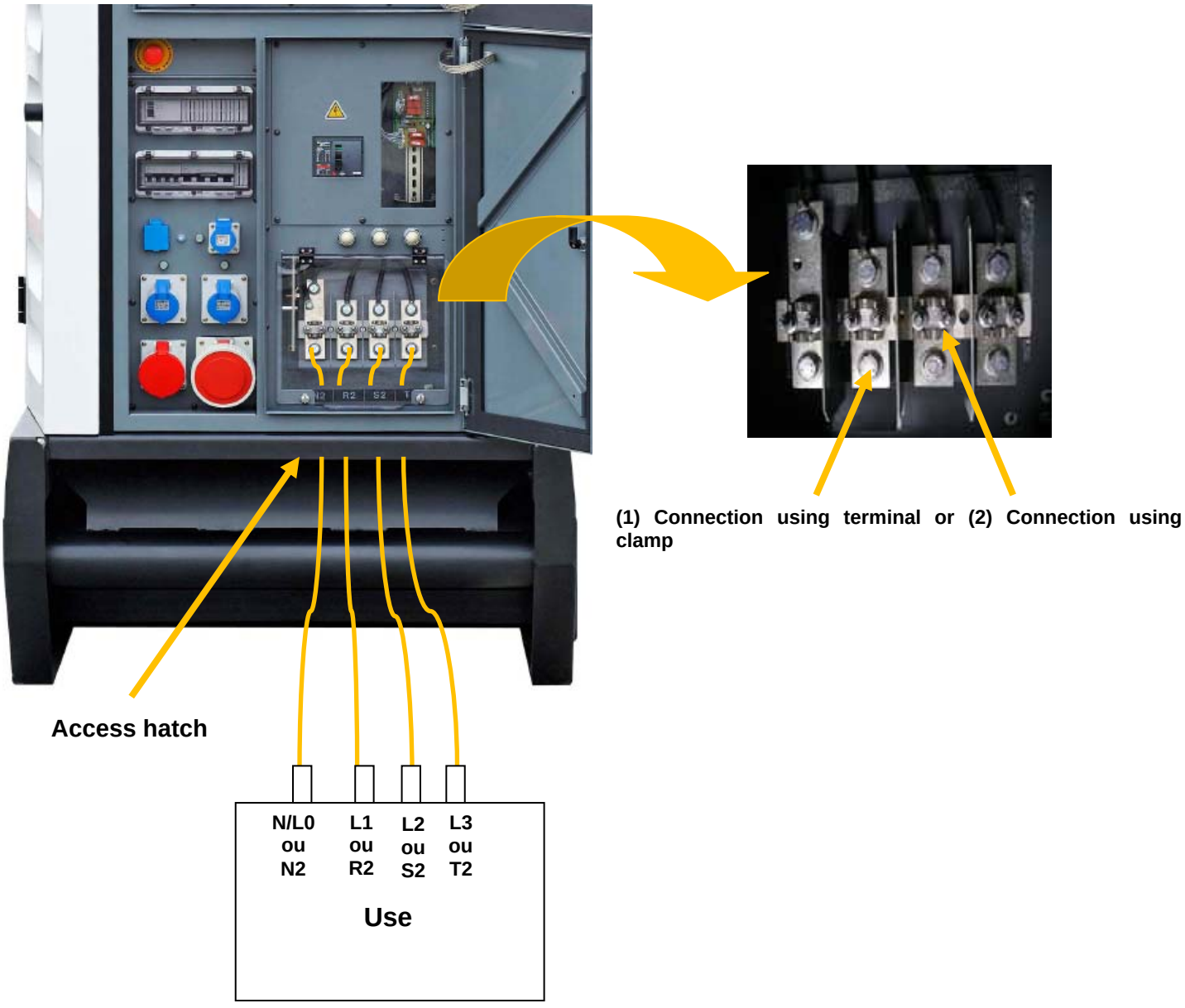
Single phase - Calculation hypothesis
Fitting method = wiring in cable runs or non perforated trays.
Permissible voltage drop = 5%
Multiconductors.
Cable type PVC 70°C (e.g. H07RNF).
Ambient temperature = 30°C.

Circuit breaker rating (A)	Cable sizes		
	0 - 50m	51 - 100m	101 - 150m
	mm²/AWG	mm²/AWG	mm²/AWG
10	4 / 10	10 / 7	10 / 7
16	6 / 9	10 / 7	16 / 5
20	10 / 7	16 / 5	25 / 3
25	10 / 7	16 / 5	25 / 3
32	10 / 7	25 / 3	35 / 2
40	16 / 5	35 / 2	50 / 0
50	16 / 5	35 / 2	50 / 0
63	25 / 3	50 / 0	70 / 2/0
80	35 / 2	50 / 0	95 / 4/0
100	35 / 2	70 / 2/0	95 / 4/0
125	50 / 0	95 / 4/0	120 / 2250MCM

3.4.3 Power connections

Warning	**Disconnect the battery leads or use the battery isolating switch before carrying out any operations on the generating set.** (To disconnect the battery, disconnect the negative lead (-) first).

1. Open the access hatch to the power section.
2. Feed the power cables through the access hatch on the genset control unit.
3. Connect the power cables to the bars. (N/L0-L1-L2-L3 or N2-R2-S2-T2).
4. Connect the power cables to the installation ensuring the live and neutral wires are correctly connected.



Warning	**Ensure that the direction of rotation of the phases is identical on the genset and the installation.** (Our gensets are factory-set with a conventional direction of phase rotation)

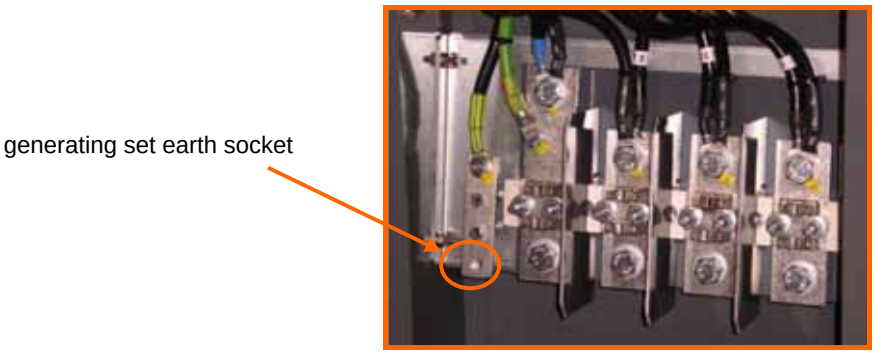
3.4.4 Battery installation

Install the battery or batteries in the immediate vicinity of the electric starter motor. The cables will be connected directly from the battery terminals to the starter motor terminals.
The primary instruction to follow is to ensure that the polarities between the battery and starter motor match. Never reverse the positive and negative battery terminals when connecting them. This could cause severe damage to the electrical equipment.
The minimum cross-section of the cables will be 70 mm^2. It varies according to the power of the starter motor but also the distance between the batteries and the set (voltage drops on the line).

3.5. Protection for individuals and equipment

3.5.1 Earth connection

For effective protection against electric shocks, the generating set needs to be earthed. To do this, use a copper wire, with a minimum cross-section of 25 mm^2 for a stripped cable and 16 mm^2 for an insulated cable, connected to the generating set earth socket and a galvanised steel earthing rod embedded vertically into the ground.



The earthing rod resistance value should comply with the values shown in the table below.
Note: use the highest differential setting from the installation as a guideline.

The resistance value is calculated in the following way: $R = \frac{Ul}{I\,\Delta n}$

Maximum resistance value of the earth socket R (Ω) according to the differential unit operational current (operation time should not be longer than 1 second).

I Δn differential	Earth R (Ω) Ul: 50 V	Earth R (Ω) Ul: 25 V
≤ 30 mA	500	> 500
100 mA	500	250
300 mA	167	83
500 mA	100	50
1A	50	25
3A	17	8
5A	10	5
10A	5	2.5

The Ul value: 25 V is required for work site installations, and livestock buildings, etc.

For a default voltage of 25 V and a default current of 30 mA, this rod must be of a minimum length of: see table below

Nature of ground	Length of rod in metres	
Thick arable land, moist compact ballast	1	
Lean arable land, Gravel, coarse ballast	1	
Bare stony soils, dry sand, impermeable rock	3.6	To obtain an equivalent length, you can use several earthing rods connected in parallel and set apart by at least their length. Example: 4 interconnected 1 metre rods separated by 1 metre.

Note: For the United States (National Electrical Code reference NFPA-70).
The generating set must be earthed. To do this, use a copper wire with a minimum cross-section of 13.3 mm² (or AWG 6, at most) connected to the generating set earth socket and a galvanised steel earthing rod fully embedded into the ground vertically.
This earthing rod embedded fully in the ground must have a minimum length of 2.5 m.

3.5.2 Earthing system principle

The **Earthing system**, or **SLT** (formerly **Neutral system**) of the electrical facility defines the situation of the generating set neutral in relation to earth and the grounds of the electrical facility at the user end.

The purpose of the earthing systems is to protect personnel and equipment by managing risks posed by insulation defects. For safety reasons, any live conducting part of a facility must be insulated from the earth. This insulation may be achieved by distance, or by using insulating materials. But with time, insulation may deteriorate (due to vibrations, mechanical impacts, dust, etc.), and therefore generate an earth with dangerous potential. This defect poses risks for personnel and property, but also continuity of service.

Earthing systems are codified by two letters that define the connections:
✓ The first letter defines the neutral connection:

I	Insulated or earthed via an impedance device
T	Connected to earth

✓ The second letter defines the grounding situation of the electrical facility:

T	Connected to earth
N	Connected to neutral

E.g.: IT = Isolated Neutral + Ground earthed

Speed		Number of conductors	Detection	Note
TT		4 poles	Measurement of residual current	Triggering of 1st fault by RCD
TN	C	3 poles	No measurement of residual current	Triggered by overcurrent protection upon 1st fault
	S	4 poles		
IT	SN	3 poles	Insulation resistance measurement	Triggered upon 2nd fault by overcurrent protection

3.5.3 TT system

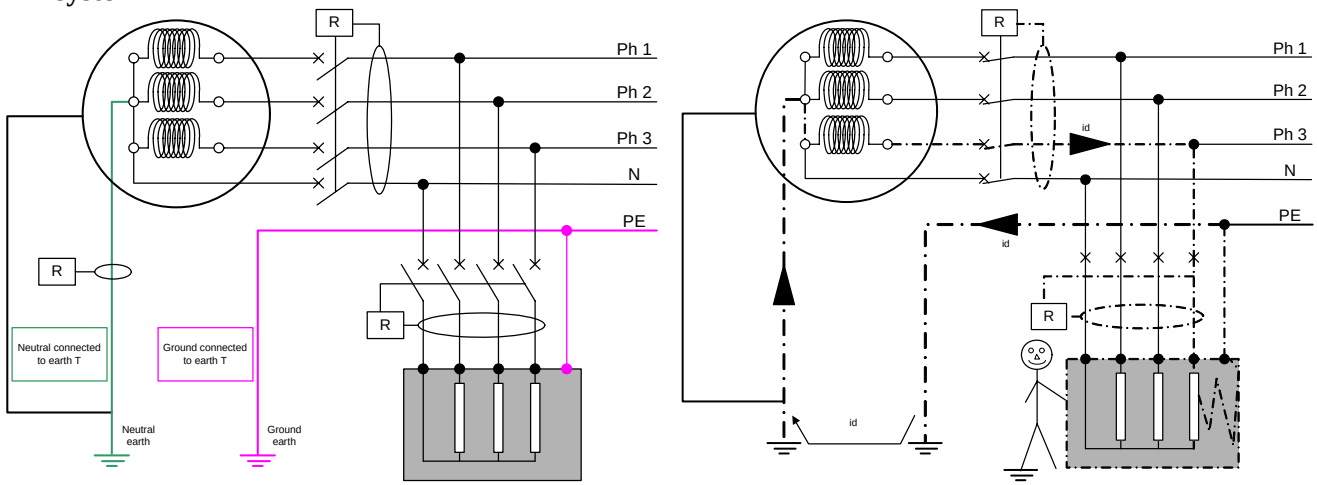


Figure 3.2: TT neutral system.

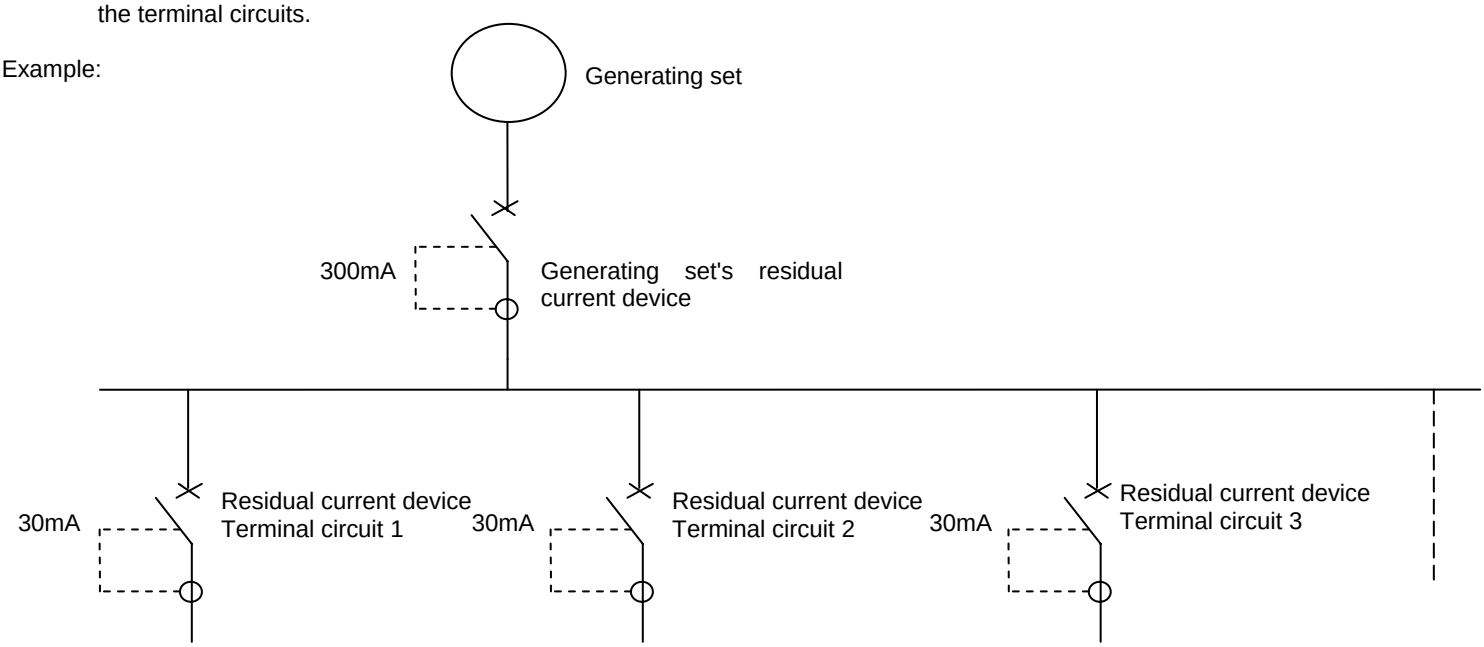
The alternator neutral is earthed, and the grounds of the user equipment have their own earth connection.
In the TT system, automatic power cut-off via a Residual Current Device (RCD) is obligatory at the upstream part of the facility, to ensure protection of personnel (with a maximum 30 mA device on outlet circuits).

3.5.4 Differential protection

In order to ensure that people are protected from electric shocks from the TT system, the generating set is equipped with a residual current device: this can be fixed or adjustable depending on the option chosen.

- If the generating set's residual current device is not adjustable and the activation threshold has been set at 30 mA, all terminal circuits in use are protected.
- If the generating set's residual current device is not adjustable and the activation threshold has been set at 300 mA, a 30mA residual current device must be added to each of the circuit outlets in use.
- If the generating set's residual current device is adjustable, (located upstream) this must be above those devices located downstream (terminal circuits); this means that continuity on clean circuits will be maintained in the event of a fault on one of the terminal circuits.

Example:

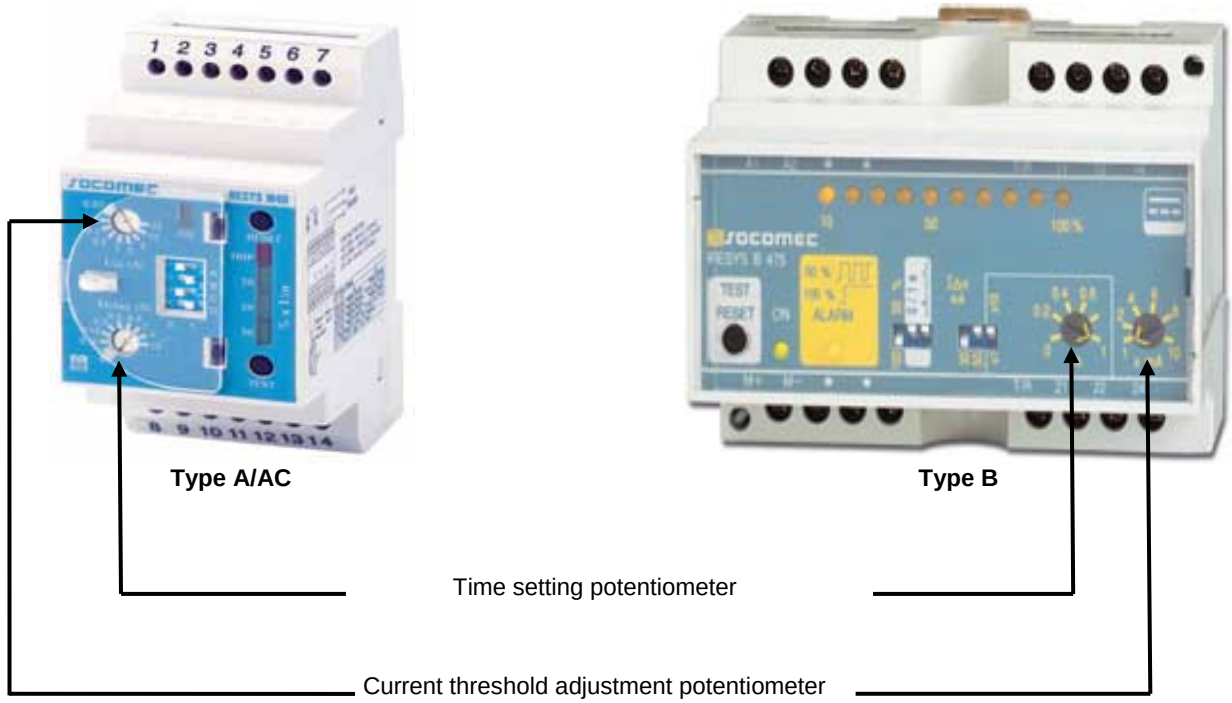


Important	**Any change to the setting on the generating set's residual current device could pose a risk to personal safety. The user will be held liable - any changes must only be made by trained, qualified engineers. When the generating set is disconnected from an installation after use, the general residual current device must be restored to factory settings by a qualified engineer who can then check this.**

3.5.5 Adjusting the genset differential protection

Before adjusting the settings on the generating set's residual current device, the following two parameters must be taken into account: the sensitivity of the current threshold and the activation time.

The generating set's residual current device must have, in relation to the downstream device (terminal circuit):
- a sensitivity three times greater.
- a longer cut-off time.



Two types of differential relay are fitted on the generating sets:

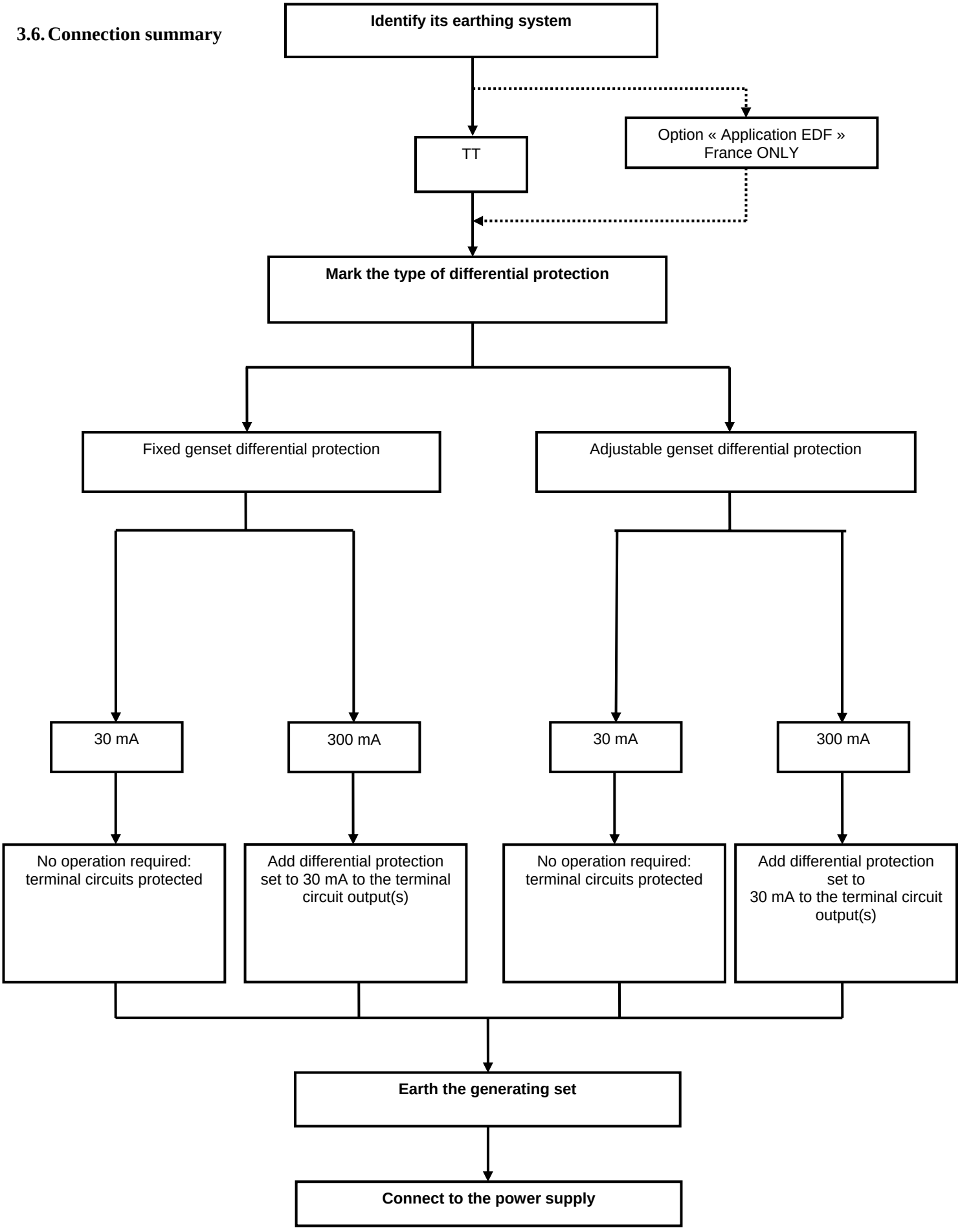
Type A:
Differential device for which operation is guaranteed:
- ✓ for residual sinusoidal alternating currents,
- ✓ for continuous pulsed residual currents,
- ✓ for continuous pulsed residual currents with a continuous component of 0.006 A with or without phase check, independent of the polarity.

Type B:
Device for which operation is guaranteed:
- ✓ as in the case of type A,
- ✓ for residual sinusoidal currents up to 1000 Hz,
- ✓ for residual sinusoidal currents superimposed on a pure continuous current,
- ✓ for continuous pulsed currents superimposed on a pure continuous current,
- ✓ for residual currents which could come from rectifier circuits i.e.:- three phase half-wave rectifier or a three-phase full-wave bridge rectifier, full-wave bridge rectifier between phases, with or without phase angle check, independent of the polarity.

Our residual current devices are factory-set with an activation threshold of 30 mA and with automatic cut-off. Depending on the use, if the residual current device is modified, it is recommended to fit a seal to prevent any tampering when the generating set is being used.

EN

3.6. Connection summary



3.7. Special arrangements

Generating sets are not fitted with protection against power surges caused by drops in atmospheric pressure or manoeuvring. The company does not accept any responsibility regarding damage caused by these occurrences.
However, lightning conductors can be installed, on the understanding that this does not give total protection.

4. Trailer

4.1. Trailer linkage

Before attaching the trailer, check the trailer hook on the tow vehicle; it should fit the trailer ring perfectly.

Warning	**Trying to tow a trailer with a non-matching device (bar, wires, cords, etc.) could lead to serious accidents.** **Also check:** **- no incipient fractures or excessive wear on the hitching system.** **- locking system is operating properly.**

To hitch the trailer, proceed as follows:

❶ Lock the wheels to stop the trailer from moving
❷ Lift up the rear trailer supports and lock them
❸ Release the parking brake
❹ Release the locking levers for the draw bar arms and adjust the ring to the same height as the vehicle hook
❺ Hitch the trailer, remove the locks on each side of the wheels then lift up the front wheel fully using its handle
❻ Connect the electrical circuit of the trailer to that of the tow vehicle
❼ Hook the handbrake safety wire onto the hook on the tow vehicle.

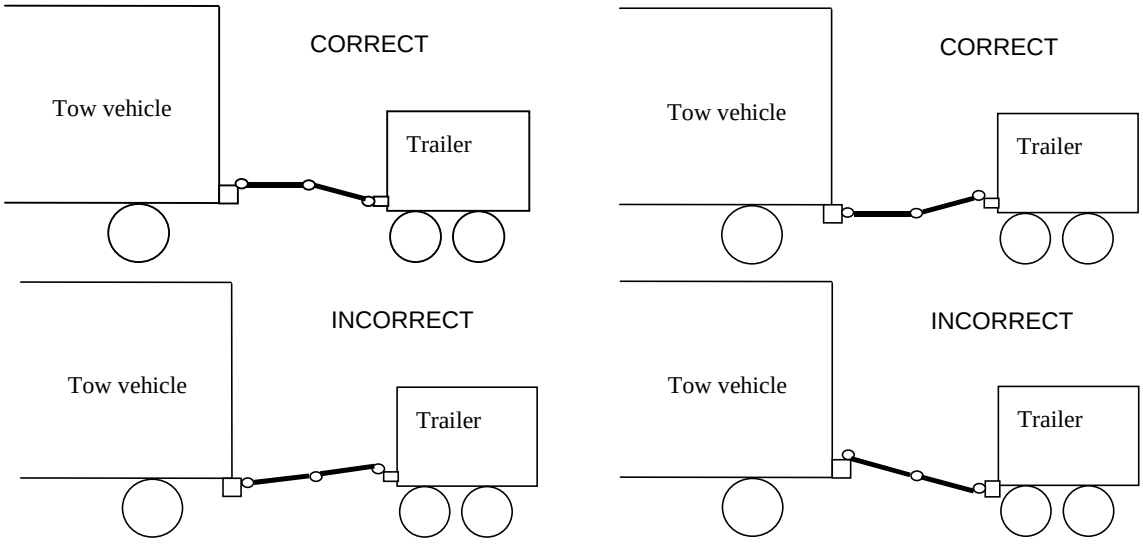


Diagram 4.1 : Coupling a trailer

4.2. Check before towing

Before towing, check the following:
- ✓ Tightness of the generating set enclosure bolts.
- ✓ Wheel tightness.
- ✓ Hitching hook locked.
- ✓ Tyre pressure.
- ✓ Signalling lights working, for "on-road" trailers.
- ✓ Enclosure doors closed.
- ✓ Parking brake released, for "on-road" trailers.
- ✓ Guide wheels (jockey wheels) and stands lifted (if fitted).
- ✓ Towbar arm locking levers tightened and pinned (if fitted with an adjustable towbar).
- ✓ Brake test, for "on-road" trailers.
- ✓ Safety cable fitted, for "on-road" trailers.

4.3. Operation

"On-site" trailer

These trailers are not fitted with a main brake, and so cannot be braked in motion; the tyres allow for a maximum speed of 27 km/h. So it is absolutely prohibited to exceed this speed.

Nor are these trailers fitted with signalling lights. On-road use is prohibited.

"On-road" trailer

The driving speed must be suited to the condition of the road and the handling of the trailer.

Driving at high speed causes heating of the tyres; so it is important to stop from time to time, and check them. Excessive heating may cause a puncture, and therefore a serious accident. For reversing manoeuvres, remember to lock the inertia brake.

Warning	Particular attention must be paid to the tightness of the wheels on new vehicles. In the first few miles' driving, heating of the brake hubs and drums will actually reduce the wheel tightness. It is therefore essential to check the tightness every 6 miles (10 kilometres) until no further loosening is noted. Nonetheless the tightness must be checked whenever you are about to tow the trailer.

Lights/signalling (only for "on-road" trailers)

Warning lights are obligatory for on-road driving. Signalling must comply with regulations in force in the country of use.

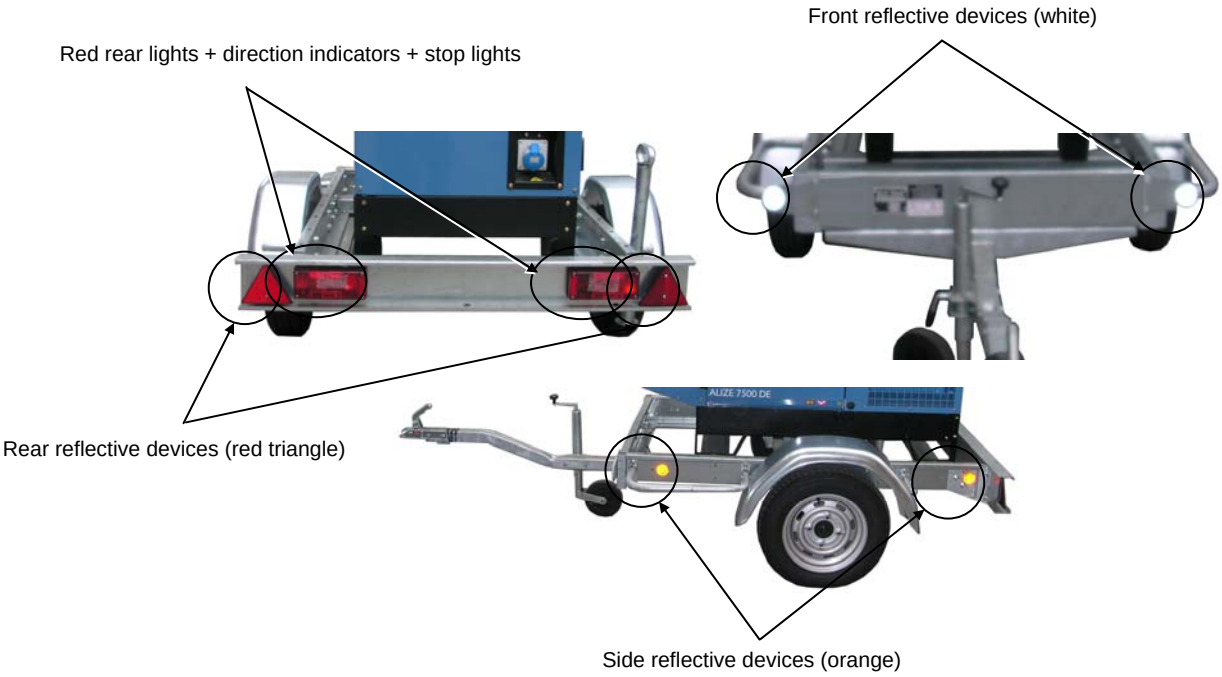

Front reflective devices (white)
Red rear lights + direction indicators + stop lights
Rear reflective devices (red triangle)
Side reflective devices (orange)

Figure 4.2: Example of French signalling

4.4. Unhitching the trailer

This operation should be carried out on horizontal, flat, stable ground.

1. Lock the wheels
2. Lower the front wheel
3. Disconnect the road signals wire
4. Refit the hitch using the wheel to release the hook ring from the tow vehicle,
5. Release the tow vehicle
6. Engage the handbrake.

4.5. Implementation for installation

Operations to be carried out:

- ✓ Ensure that the ground is strong enough for the assembly not to sink into it.
- ✓ Unhitch the trailer.
- ✓ Immobilise the trailer by placing chocks under the wheels.
- ✓ Fully engage the parking brake (if fitted).
- ✓ Using the front wheel, position the generating set as close to horizontal as possible.
- ✓ Lower the stands (if fitted), and lock them.

4.6. Break transmission adjustment

Important	- The handbrake is used only as a parking brake. - Setting is carried out starting with the brakes moving to the brake control.

❶ After fitting the wheels on the axle, turn the wheels in the FORWARD direction (on all RA 2 type brakes, check that the adjustment screw 8 reaches the “FORWARD” stop on the brake backing plate).

❷ Adjust the brake setting using screw 8, with the cables not connected to the cross bar(s). The shoes should rub the drum slightly.

❸ Connect the brake cables to the cross bars(s) and tighten the nuts and lock nuts, leaving the end of the threaded end protruding by around 10 mm (Fig. 4.4).

IMPORTANT: Wherever possible, cables must cross over to achieve the highest possible gain curve (Fig. 4.5).

❹ Check that the parking lever 1 is in the ‘REST” position and that the compensating spring 4 is completely free on its rod (unscrew the nuts 5 fully).

❺ Check that the hook slide 2 is not compressed and the yoke 3 is in the pulled out position.

❻ Fit the transmission and adjust the assembly using the tensioner 6 until a gap (J1) of 1 mm max is obtained between the linkage 9 and slide 2.

❼ Adjust the compensating spring 4 at one end pressing it against the anchorage plate, and at the other end leaving a 2 mm gap (J2) max between the spring and nuts 5.

❽ Tighten all the lock nuts.

Checking the setting (trailer on axle stands):

❶ Pull the parking lever 2 notches - the wheels cannot turn in a FORWARD direction.
The wheels can turn in REVERSE (adjustment screw 8 switches to the REAR position).

❷ Pull the parking lever fully.
The wheels will not turn either in FORWARD or REVERSE and the cross bar(s) must remain parallel with the axle body.

- ➢ Check the transmission setting after 180 miles (300 km) (running in period) and if necessary adjust the gap (J1) using the tensioner.

Parking

- ➢ The lever must be fully pulled up, so that the compensating spring is fully compressed.
- ➢ Every 900 miles (1500 km), check the braking settings and distribution on all the wheels.

Important

- ➢ The brake controls are designed to draw trailers behind flexible suspension touring vehicles. If used behind an HGV, be sure to provide the fitted ball joint with a shock absorber to prevent premature wear.
- ➢ During any manoeuvres with the trailer coupled, do not turn more than 90° or force reverse.

- ➢ The specifications of our brake controls are indicated on a manufacturer's plate, and the items on this should be supplied to us when requesting replacement parts, in particular for the shock absorber, of a special type, approved by the Service des Mines to correspond to European standards (it is advisable to have a spare shock absorber to enable instant repairs).

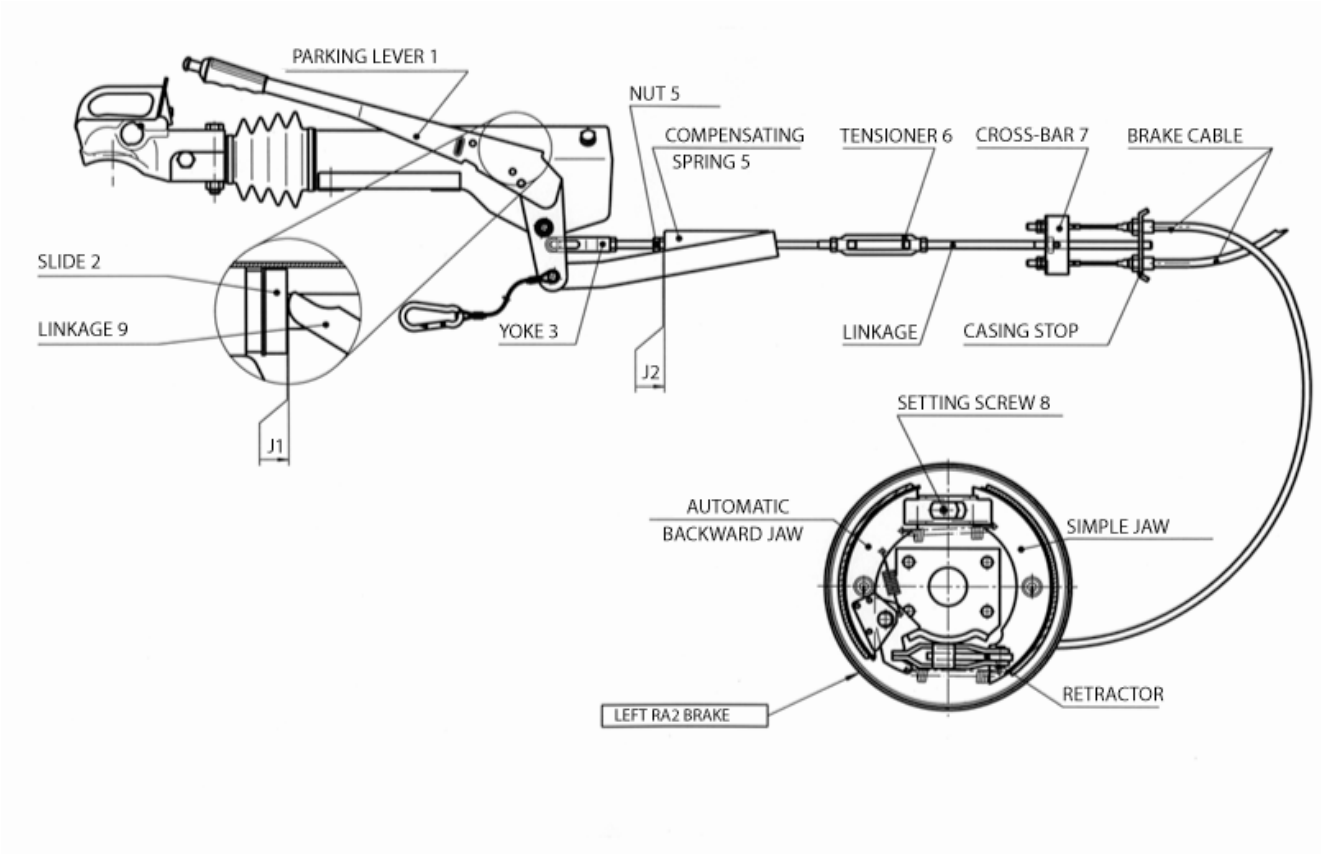


Figure 4.3: Braking transmission

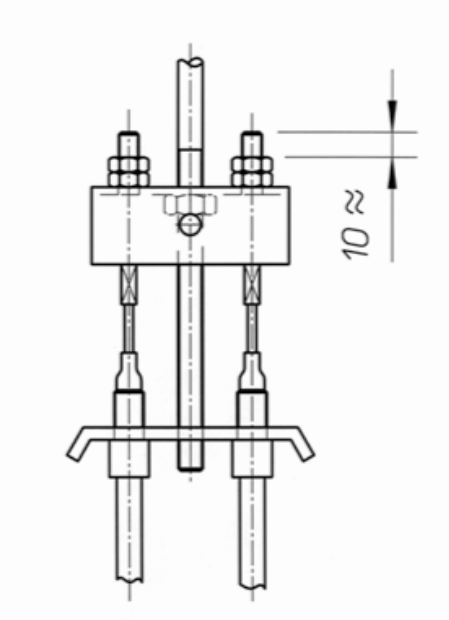


Figure 4.4: Cross bar fitting

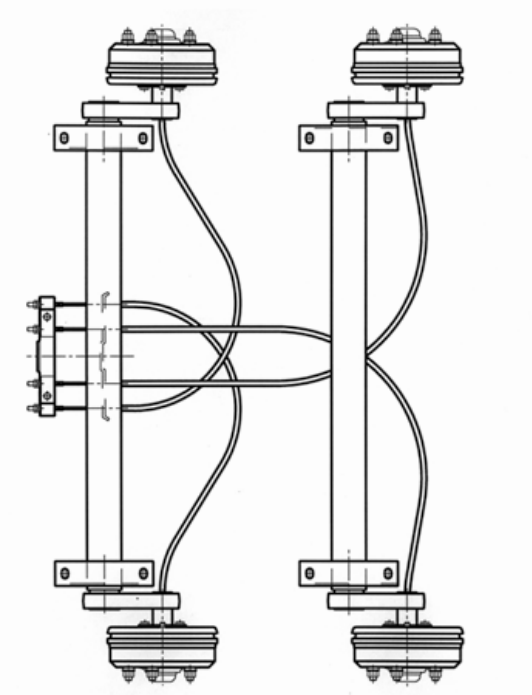


Figure 4.5: Tandem bearing fitting

4.7. Faults and repairs

Fault observed	Origin	Solutions
Erratic braking of trailer	- Faulty shock absorber	Replace the shock absorber
Braking too weak	- Jaws worn	Replace the jaws
	- Jaws not run in	Fault will disappear only after running in
	- Incorrect linkage setting	Adjust the setting
	- Significant friction on the slide	Grease the sliding parts
	- Slide corrosion	Remove the corrosion and grease
	- Coupling height does not match that of the towing vehicle	Adjust the height so that the two parts are in the same horizontal plane
Drum temperature abnormally high	- Incorrect linkage setting	Adjust the settings
	- Incorrect brake setting	Adjust the settings
	- High levels of dust in the drums	Remove the dust
	- Jaws, springs, drums damaged	Replace the damaged parts
	- Brake cables or link rod damaged	Replace the damaged parts
Jerky braking	- Incorrect linkage setting	Adjust the settings
	- Interfering parts on the slide	Remove, clean and grease
	- Corroded slide	Remove the corrosion and grease
	- Damage to slide guide rings	Replace the rings (and possibly the slide) and grease
	- Faulty shock absorber	Replace the shock absorber
Trailer tending to swerve upon braking	- Cross-bar(s) not balanced	Adjust the cross-bar(s)
	- Different brake setting on the two sides	Adjust the brake settings
	- Cables damaged or incorrectly fitted	Replace the damaged parts Refit the cables
	- Poor load distribution	Check the load distribution
When starting the trailer holds back the towing vehicle	- Damage to slide or to guide rings	Replace the faulty parts and grease
	- Slide corrosion	Remove the corrosion and grease
	- Tie rod damaged	Replace the tie rod and adjust the settings
	- Linkage damaged or incorrectly set	Replace the damaged parts and adjust the settings
	- Brake on	Loosen the brake
Play in the coupling head	- Head worn (see wear indicator)	Replace the head
	- Ball joint worn	Replace the ball joint
Parking braking too weak	- Compensating spring incorrectly set	Adjust the setting
	- Braking system incorrectly set	Adjust the setting
	- Notched sector damaged	Replace the sector and adjust the setting
	- Lever ratchet worn	Replace the lever and adjust the setting
	- Cable ruptured	Replace the cable and adjust the setting

4.8. Electrical connection diagram

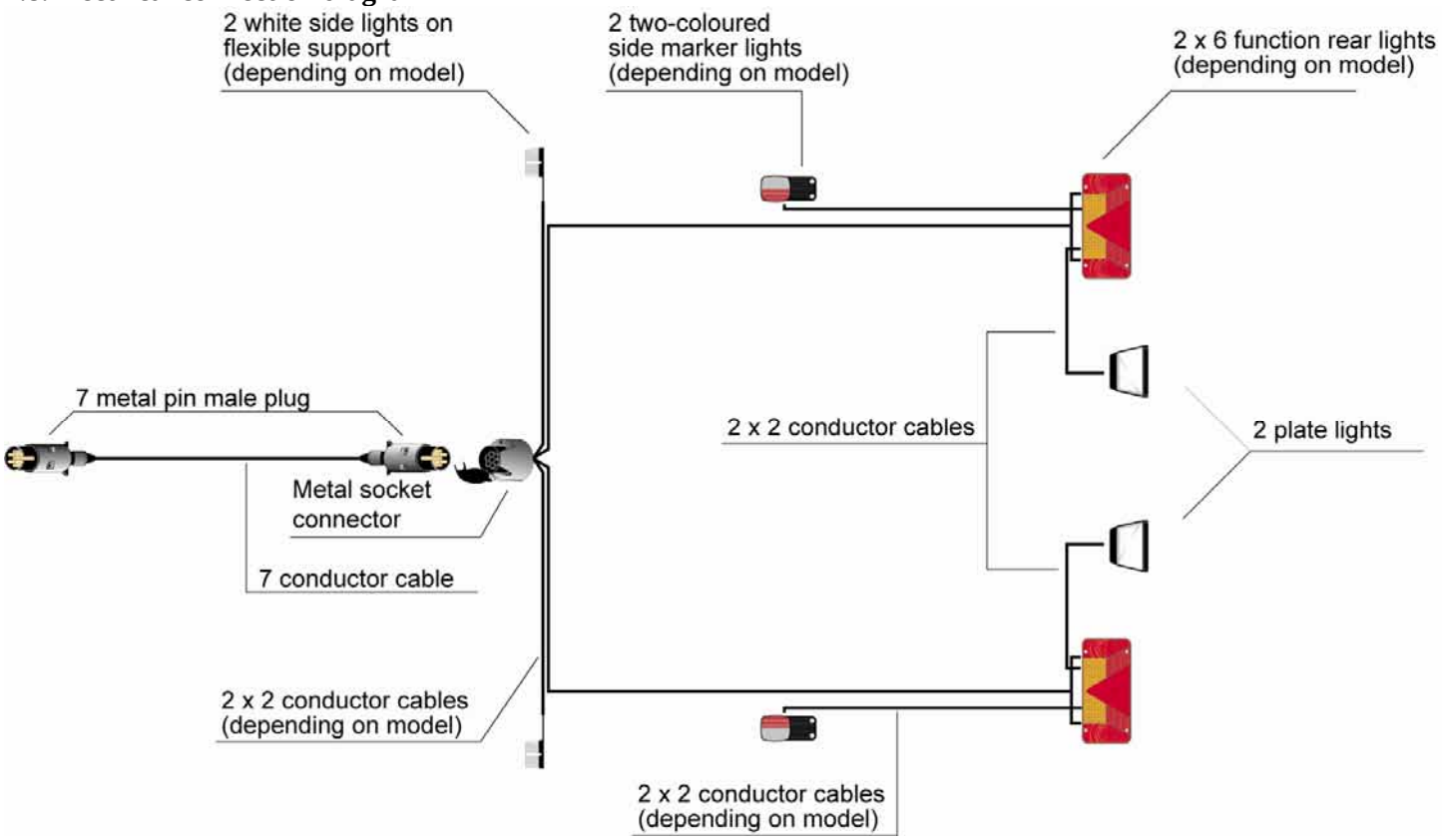

2 white side lights on flexible support (depending on model)
2 two-coloured side marker lights (depending on model)
2 x 6 function rear lights (depending on model)
7 metal pin male plug
Metal socket connector
7 conductor cable
2 x 2 conductor cables
2 plate lights
2 x 2 conductor cables (depending on model)
2 x 2 conductor cables (depending on model)

Figure 4.6 : Electrical connection diagram

4.9. Complete wheels technical information

TYRES					**COMPLETE WHEELS**	
Dimensions	Indices	Diameter (mm)	Cross section (mm)	Radius under load (mm)	Load (Kg)	Pressure (bar)
135 R 13		550	134	265	335	2.4
145 R 13	75 T	566	145	272	387	2.4
155 R 13	79 T	578	150	277	437	2.4
145/70 R 13	71 T	534	150	259	345	2.5
155/70 R 13	75 T	548	147	263	387	2.5
185/70 R 13	86 T	594	185	285	530	2.5
165 R 14 C	98 N	622	172	284	650	3.8
155/70 R12	100 N	525	155	244	650 (1) 800 (2)	6.25
185 R 14 C	102 P	650	188	316	675 (1) 850 (2)	4.5
195 R 14 C	106 P	666	198	32	950	4.5
195/50 x 10	98 N	450	190	-	750	6.0

(1) Wheel with 4 holes (2) Wheel with 5 holes

5. Preparation before operating the set

	The inspections referred to in this section enable the electrical generator set to operate. Specific skills are required to carry out these operations. They must only be entrusted to personnel with the necessary skills. Failure to follow these instructions in any way could result in malfunction or very serious accidents.
Danger	

5.1. Installation checks

- Check that the general recommendations from section "Installation" (ventilation, exhaust, connections, etc.) are followed.
- Carry out level checks (oil, coolant, diesel, battery).
- Ensure that the generating set is correctly earthed (earthing rod).
- Ensure that the electrical connections have been made properly.
- Ensure that the fuel connection has been made properly (valve position), if the generating set is equipped with the three-way valve option enabling external supply.

5.2. Checks after starting the generating set

- Carry out the mechanical checks (oil pressure, water temperature, absence of noise, etc.).
- Carry out the electrical checks (voltage, current, frequency, rotary field, etc.).
- Carry out the safety checks (emergency shutdown, oil pressure, coolant temperature, etc.).
- Carry out the check on Normal/Emergency Inverter switching or coupling (if fitted).

6. Using the generator set

6.1. Pre-Start Inspection

- Inspecting the engine compartment

Inspect the engine carefully.
Wipe all the grease fittings and caps before carrying out any maintenance in order to reduce the risk of contaminating the circuits.

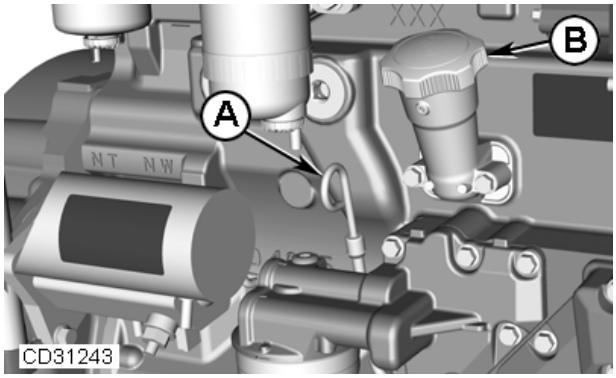
- Checking the engine oil level

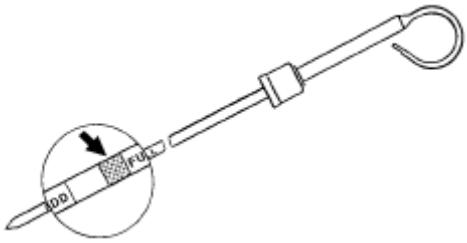
⚠ Important	- **Do not** top up the oil if the oil level is not **below** the low level marker. - **Do not** exceed the hatched area The oil level is correct if it is within the hatched area.

❶ Check the oil level using the dipstick (A).

❷ Top up the oil as required.
Use an oil whose viscosity is suited to the seasonal conditions.

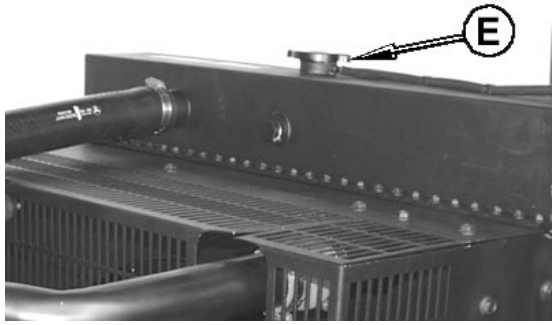
❸ Pour the oil through the rocker cover filling port (B).





- **Checking the coolant level**

⚠ Warning	Fluid may abruptly exit the cooling circuit and cause serious burns. Only remove the filler cap once the engine and cap have cooled sufficiently to enable them to be handled with bare hands. Firstly, loosen the cap slightly by one notch to eliminate any pressure, then remove it.



❶ Remove the cap from the radiator (E) and check the coolant level.
The level should reach the lower section of the filler neck.

❷ Fill the radiator with the appropriate coolant if the level is too low.

❸ Check for leaks in the cooling circuit.

- **Checking the air filter**

Important	A clogged filter element limits the engine's air intake and a reduced air supply to the engine.

If the air filter is fitted with a dust control valve (A), press the tip of the valve to evacuate any accumulated dust particles.

Check the air filter clogging indicator (B). If the indicator is red, clean the air filter.

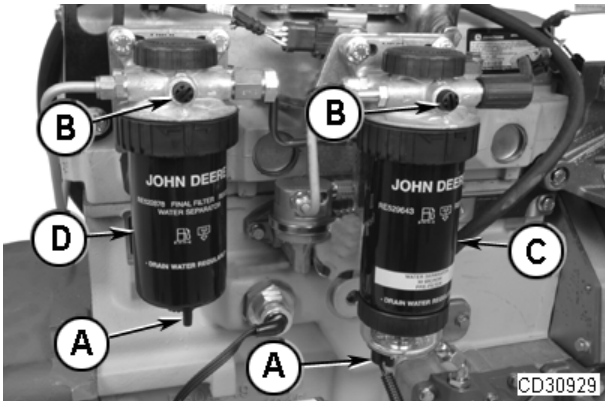
- **Checking the fuel filters**

Danger	**Drain water into a suitable container and dispose of properly.**

Note: Engines have two fuel filters (primary and final) equipped with a water sensor. Depending on application, an indicator light on the instrument panel signal the operator that water should be drained from filter bowls.

Check fuel filters (C) and (D) daily for water or debris and drain as necessary.

❶ Loosen drain plugs (A) at bottom of both fuel filters two or three turns.
❷ Loosen air bleed plugs (B) two full turns and drain water into a suitable container.
❸ When fuel starts to drain out, tighten drain plugs securely.
❹ Bleed fuel system.



A – Drain Plug
B – Air Bleed Plug
C - Primary Fuel Filter
D - Final Fuel Filter

6.2. Generator set with NEXYS control panel

6.2.1 Control panel presentation

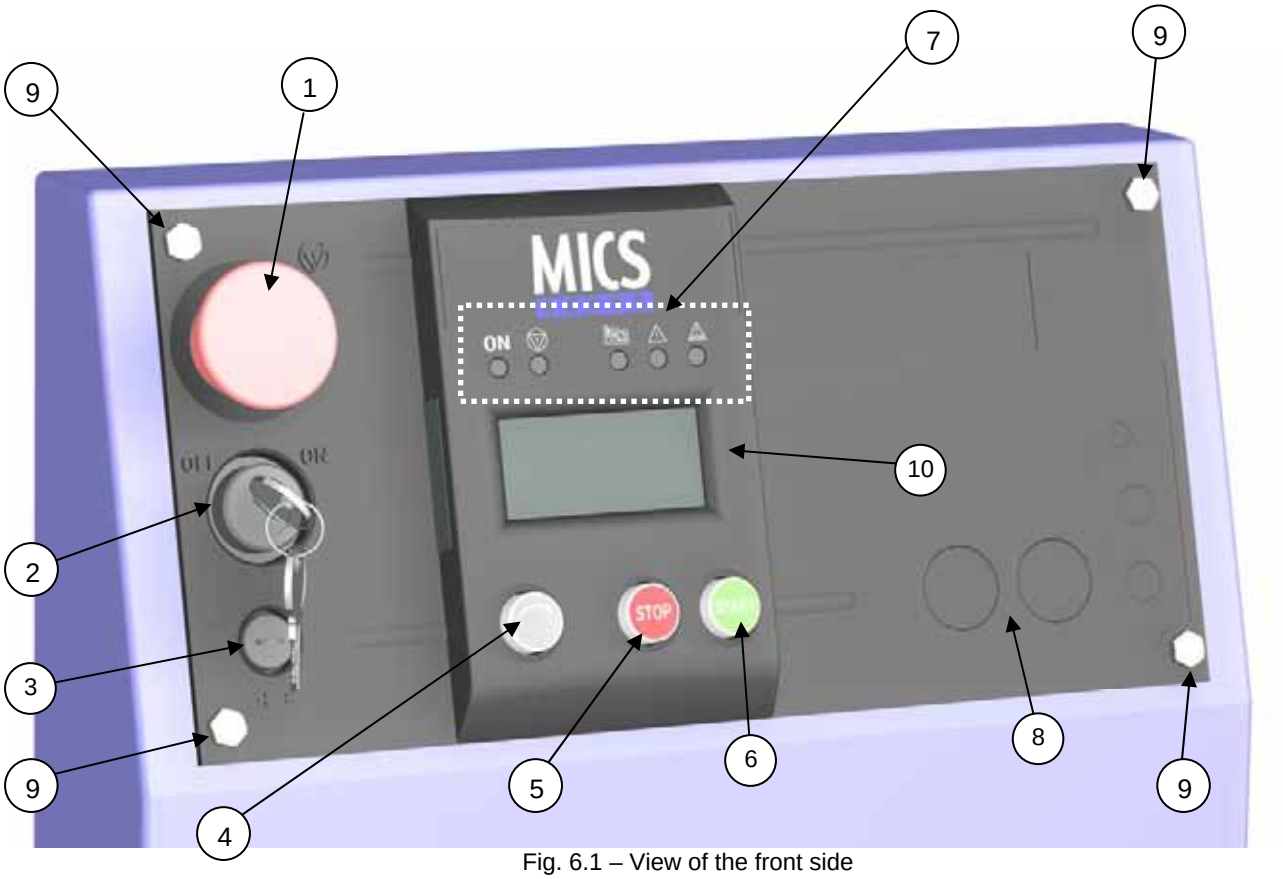


Fig. 6.1 – View of the front side

① Emergency stop button for switching off the generating set in the event of a fault which could endanger personnel or damage equipment
② Key switch for starting up/shutting down the module and RESET function
③ Electronic card protection fuse
④ Screen-scroll button, press successively to access the various screens which are available
⑤ STOP button, press to switch off the generating set
⑥ START button, press to switch on the generating set
⑦ Normal operation LEDs and alarm and fault warning LEDs
⑧ Slot reserved for panel fascia options
⑨ Mounting bolt.
⑩ LCD for displaying alarms and faults, operating states, electrical and mechanical quantities

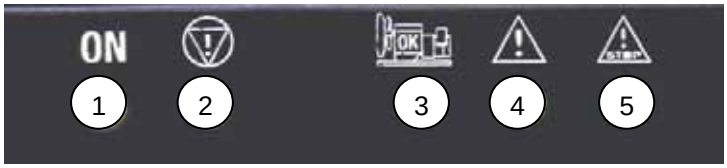


Fig. 6.2 – Description of the LEDs

A lit LED indicates:

① Module being supplied (green, lights up and remains lit)
② Emergency stop activated (control panel or external emergency stop) (red, lights up and remains lit)
③ Visualisation of starting phase and speed/voltage stabilisation (flashing) and generating set operating OK or set ready to generate (green, lights up and remains lit)
④ General alarm (orange, flashing)
⑤ General fault (red, flashing).

6.2.1.1. Introduction to pictograms

The pictograms are as follows:

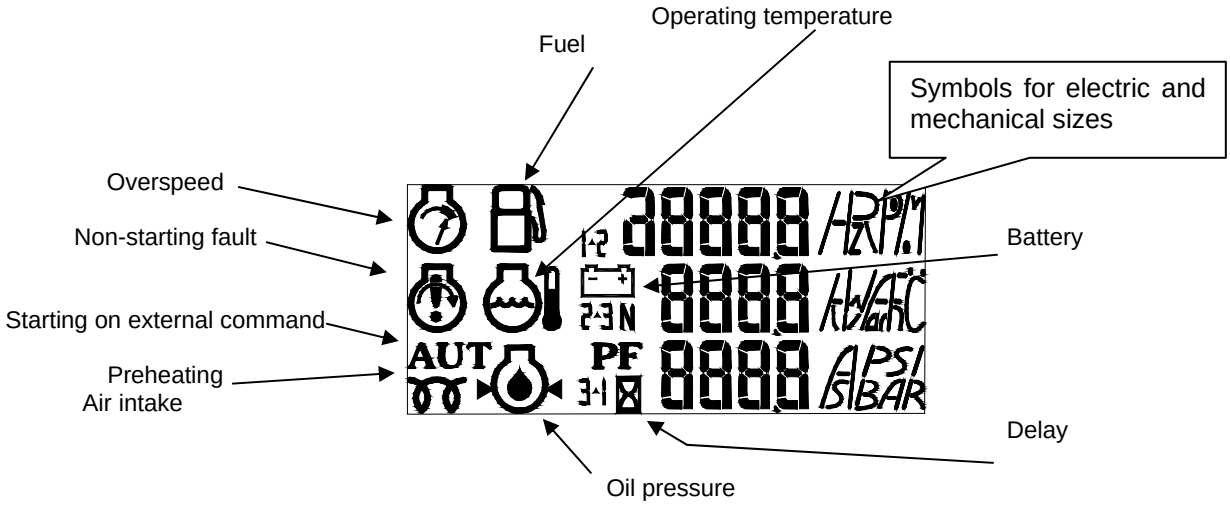


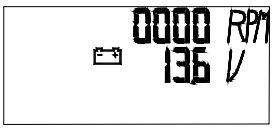
Fig. 6.3 – View of pictograms

- The "fuel level" pictogram is used to display the fault, the alarm and the fuel level.
- The "operating temperature" and "oil pressure" pictograms are used to display the fault and analog value
- The "overspeed" and "non-starting fault" pictograms are used to display the fault.
- The "battery" pictogram is used to display the "alternator charge" fault and to indicate the battery voltage.

6.2.2 Manual starting

Danger	Check that the generating set circuit breaker has triggered.

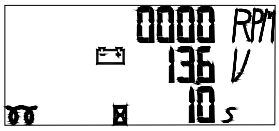
❶ connect the generating set battery.
❷ turn the key switch to the ON position (without forcing it)
- ✓ All of the LEDs light up for 2 seconds, to confirm that they are operating correctly.
- ✓ If the LEDs do not light up, check the protection fuse and replace it if necessary.
- ✓ All the items on the screen are displayed for 2 seconds.
- ✓ Only the "ON" LED remains lit to indicate that the module is powered up.
- ✓ The following screen appears.



The first line displays the motor speed in RPM.
The second line displays the battery voltage in volts (V).

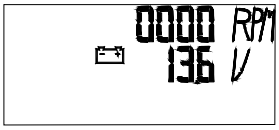
- ✓ Check the battery voltage (min. 12 V)

❸ Press (once briefly) the green "START" button.
- ✓ If the motor is equipped with an air preheating system, there is a 10-second delay before the motor starts (preheating activation period).
- ✓ The following screen appears



The third line displays the air preheating time remaining (with pictograms representing a resistor and an hourglass).

- ✓ If the motor is not fitted with an air preheating system or once the preheating delay has elapsed, the engine starts up (start of a cycle comprising 3 attempts to start up the engine).
- ✓ The following screen appears.



Warning	The number of successive and automatic starting attempts is limited to 3.

Note: the LED flashes as soon as the START button is pressed and continues to flash until the frequency stabilises if a "measurements" card has not been inserted and until the frequency and voltage stabilise if a "measurements" card has been inserted.

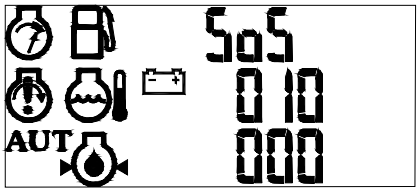
Following stabilisation, the LED light comes on continuously.

6.2.3 Switching off

❶ trigger the circuit breaker located at the base of the centre console
❷ Let the motor run under no load for 1 to 2 minutes to allow it to cool.
❸ press the "STOP" button to stop the generating set.
❹ switch off the MICS Nexys module by switching the key to "OFF" (without forcing it).

6.2.4 Alarms and faults

The appearance of a fault or an alarm causes the following screen to be displayed (one or more pictograms or a fault code along with the SOS message are displayed).

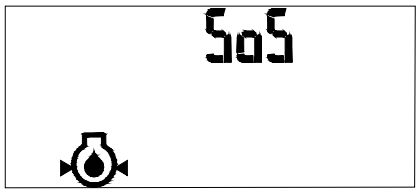
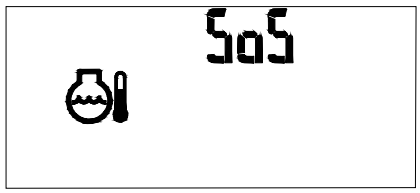
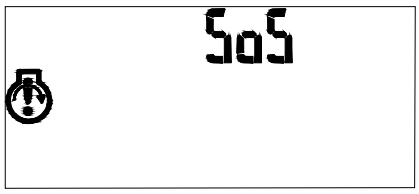
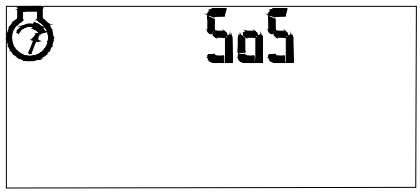
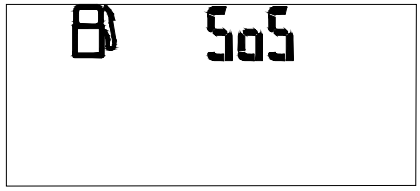


The user can access the following screens by pressing the key

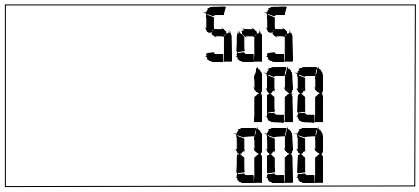
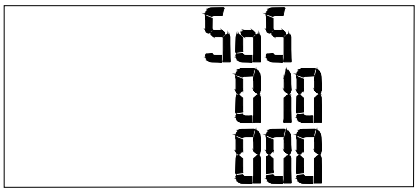
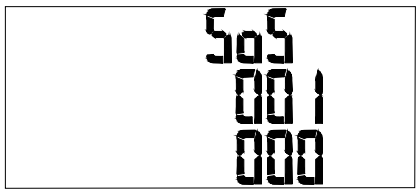
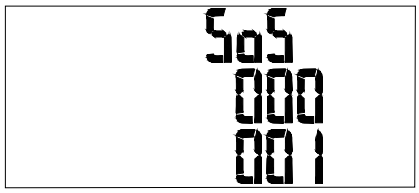
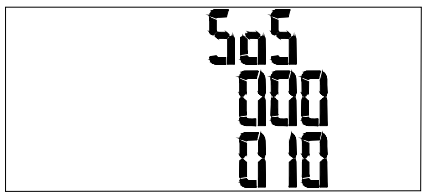
The fault or alarm screen will disappear once the fault or alarm has been removed.
Only one fault is displayed on this screen (the fault which caused the generating set to stop).
If one or more faults have appeared after the first fault, they can only be displayed after the first fault has been reset (press "Reset" as many times as the number of faults present).
Note: an alarm can appear at the same time as a fault.

6.2.5 Faults and alarms - Details

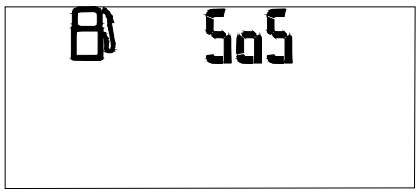
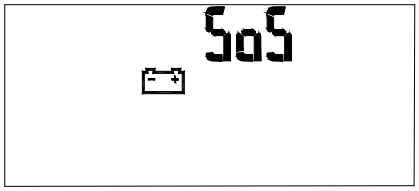
List of faults which will cause the generating set to stop and generate a pictogram

Oil pressure fault: Indicates that the oil pressure is incorrect	Associated pictogram 
Engine temperature fault: Indicates that the engine temperature is too high.	Associated pictogram 
Non-starting fault: Indicates that there have been three consecutive unsuccessful starting attempts.	Associated pictogram 
Overspeed fault: Indicates an excessive generating set running speed.	Associated pictogram 
Low fuel level fault: Indicates the need to top up the fuel.	Associated pictogram 

List of faults which will cause the generating set to stop and generate a fault code

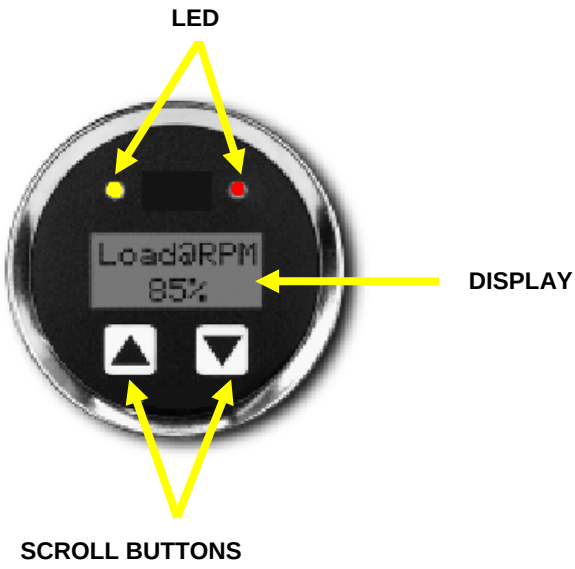
Low coolant level fault: indicates that the level of coolant is low in the radiator (linked to a two second time delay). Or Overload or short-circuit fault (optional): with the circuit breaker SD contact closing (overload or short-circuit), the generating set switches off immediately also causing the main circuit breaker to be triggered.	Associated message 
Additional fault linked to message opposite: is displayed in the following two cases: ➢ Differential fault (1) ➢ insulation fault (2) (1) Differential fault (optional): with a differential fault causing the activation of the differential relay, the generating set stops immediately also causing the main circuit breaker to be tripped. (2) Insulation fault (optional): with an insulation fault causing the activation of the control unit performing insulation, the generating set stops immediately.	Associated message 
Underspeed fault: indicates an incorrect rotation speed (below 1000 rpm).	Associated message 
Emergency stop or external emergency stop fault	Associated message 
"STOP" fault activated if the "STOP" button is pressed whilst the "AUT" LED is flashing to indicate that the generating set is operating in automatic mode.	Associated message 

List of alarms associated with a pictogram

Low fuel level alarm: Indicates the need to fill up with fuel.	Associated pictogram 
"Alternator charging fault" alarm indicates a problem affecting the alternator charging rate.	Associated pictogram 

6.2.6 MURPHY diagnostic module

The fault finding module (MDDM) is an indicator for analysis and fault finding designed and manufactured for reading information available on the J1939 CAN Bus. The fault finding module is easy to use and will enable you to view the values of the various engine parameters and engine operating status codes.
It shows two lines, each of 8 characters, on a backlit LCD display. Two scroll buttons enable you to navigate in the menus and parameters. Two LEDs, one red and one orange, indicate the fault or alarm status of the engine or ECU.



A- <u>Machine Parameters</u>

The following parameters are available on the Murphy fault finding module:
- working hours counter
- engine speed
- battery voltage
- engine speed
- coolant temperature
- oil pressure
- fuel economy
- air manifold temperature
- actual consumption
- active status codes
- status codes recorded coming from the engine
- MDDM20 parameter configuration for display
- display of the engine configuration parameters

-etc. depending on the type of engine.

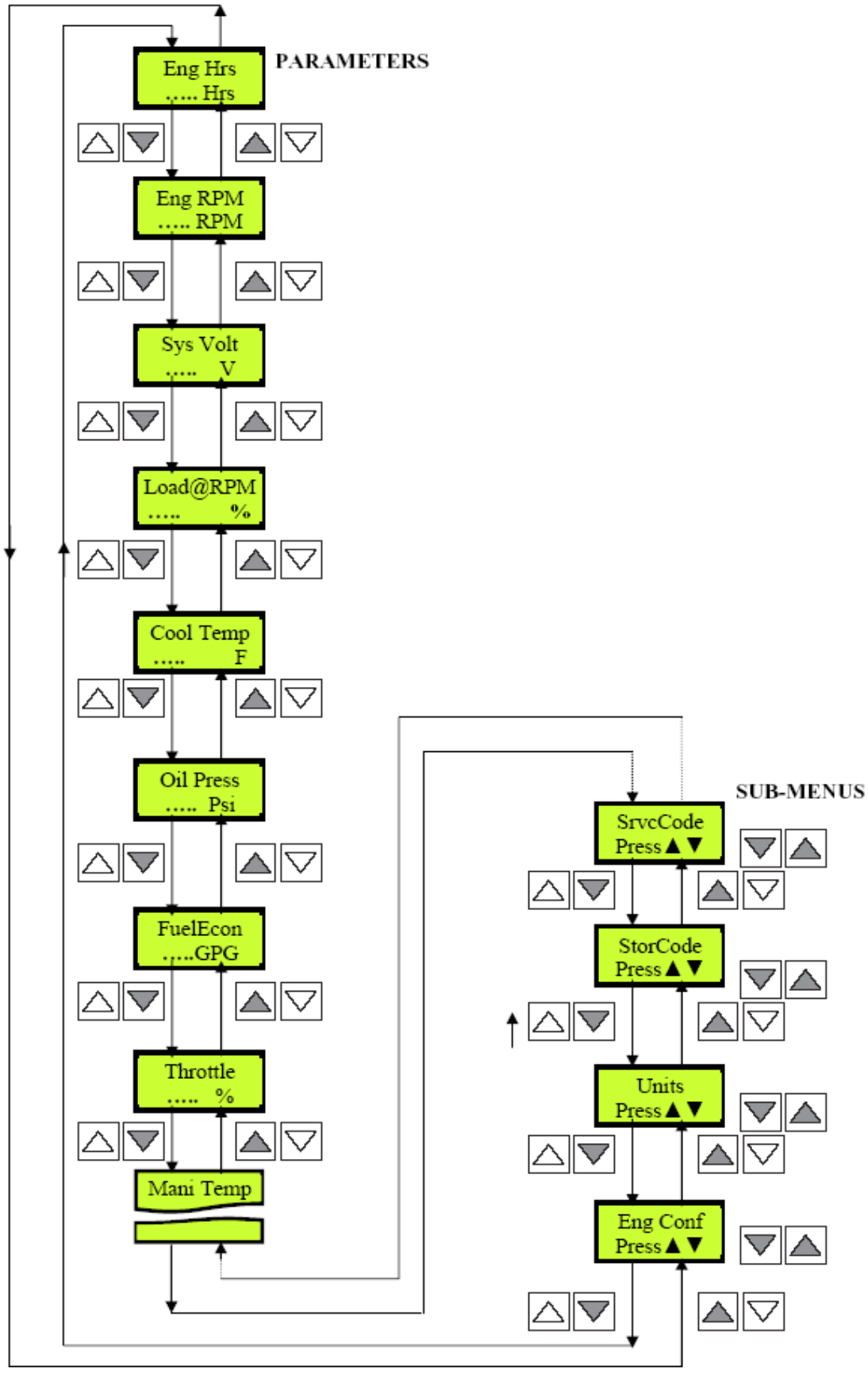
B-<u>Use</u>

The Murphy module (MDDM) offers simple menu navigation:

1.To browse the list of parameters, press the Up and Down buttons.

2.To enter or exit a sub-menu, press both arrows simultaneously.

The following diagram shows the structure of the main menu and how to go to each parameter:



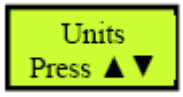
The Parameter menu: to navigate in this menu simply use the arrow buttons separately.

The sub-menus: The sub-menus are available at the end of the parameter menu. To go to these sub-menus, scroll through the parameters using the ▲ and ▼ buttons until you reach the required sub-menu.

C- <u>The Sub-menus.</u>

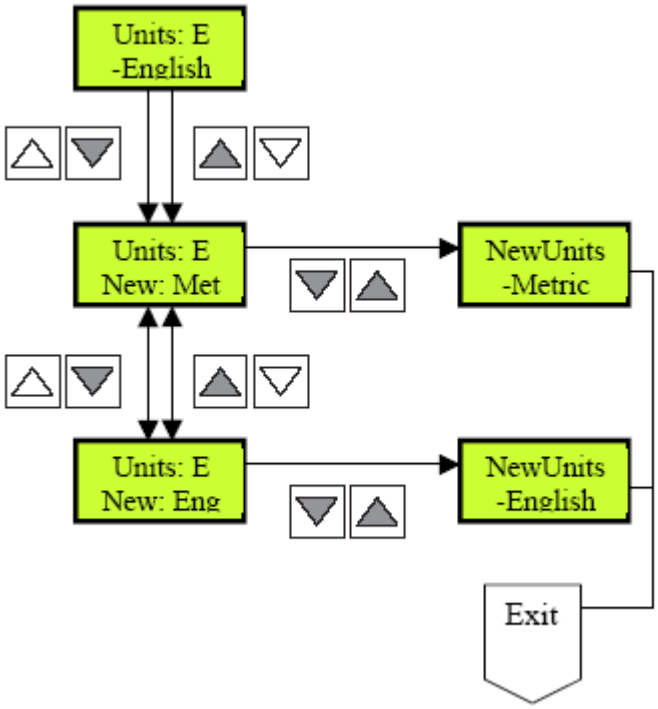
The sub-menus enable certain aspects of the fault finding module display to be modified.

<u>Changing the unit of measurement:</u>
There are two display modes available for units: English or metric. To change your units of measurement, use the ▲ and ▼ scroll buttons until you get to the sub-menu:



Press the ▲ and ▼ arrows simultaneously if you want to retain the current designation.

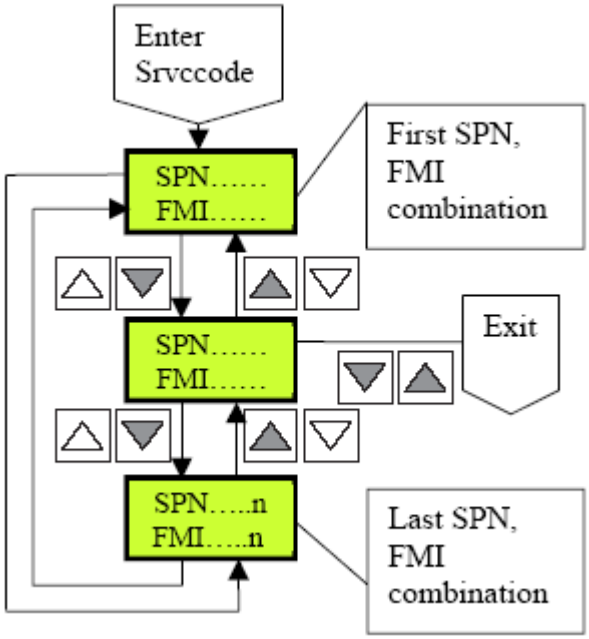
Press one of the scroll buttons to show the second mode for displaying units. If you want to retain the second display mode, confirm this by pressing the ▲ and ▼ buttons simultaneously.



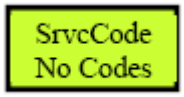
D-Displaying the active service codes:

The fault finding module enables the machine faults and alarms to be displayed in real time. When a fault appears, the display shows the message "SrvcCode" every five seconds between displaying the current parameters.

The orange LED will light up when an alarm code is displayed (engine does not stop), the red LED will light up when a fault code is displayed.
SPN and FMI codes are used in standard J1939 to identify faulty equipment
SPN: Suspect Parameter Number.
FMI: Failure Mode Indicator.



In the event that there are no active fault codes, the following screen will appear:

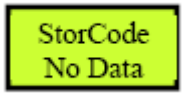


Depending on the SPN/FMI code, refer to the attached "List of engine fault codes" and "Engine user and maintenance manual" for help on fault finding and maintenance.
Note that the manufacturer documents do not always stipulate the SPN used, for example:
-Volvo uses a set of codes called PID (Parameter Identifier) or SID (System Identifier); these two names relate to standards J1587 or J1979, but in the case of VOLVO engines they relate to standard J1587. These two codes find their equivalent in standard J1939 (SPN). The attached "List of engine fault codes" indicates the SPN equivalent to Volvo's SID and PID.
- John DEERE complies with standard J1939 and uses SPN codes.

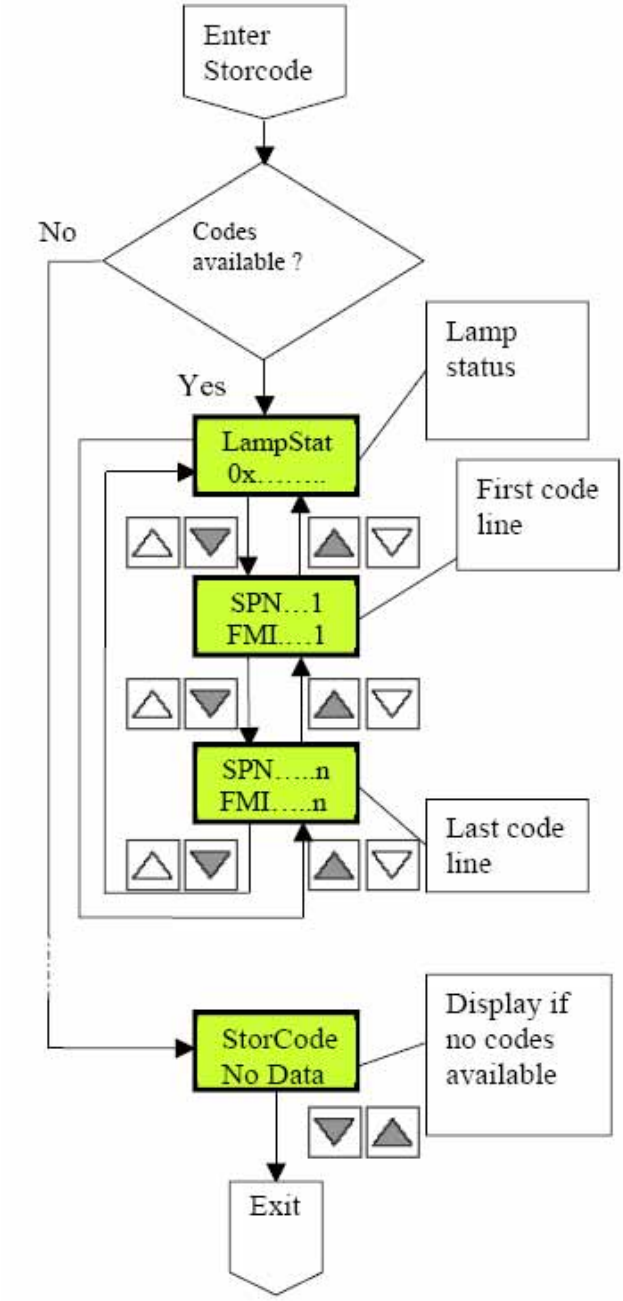
E-display of machine codes programmed:

The MDDM can display the codes of services programmed in the ECU memory. These programmed service codes are useful for generating set fault finding and maintenance.
To display the programmed codes, scroll through the parameters until you reach the following sub-menus:

In the event that there are no programmed codes to display, the following screen will appear:



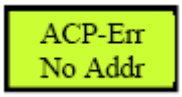
The purpose of programmed codes is to create a fault log, which is used to determine recurrent faults and thereby carry out effective corrective and preventive maintenance on the engine; also it not desirable to delete these when the generating set is in operation onsite. Note that at the test bench outlets the EEPROM memory, in which the programmed codes are stored, is reset to zero.
The following diagram shows the structure of the STORCODE (programmed code) menu and how to go to each parameter:



F)-Fault finding module internal errors.
Like any equipment using internal memory and a program, the fault finding module generates fault codes. Two types of code can be recognised:
- Address Claim Procedure Errors
- Run Time Bus Errors.

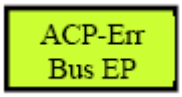
Address Claim Procedure Errors (ACP-Err):
The following fault codes relate to the switching on of the fault finding module.

Error Code 1:



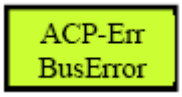
When switched on, the fault finding module must issue a request to the ECU for the network addresses used in order to exploit them; this screen appears when:
- an address cannot be used.
- the fault finding module cannot find the default addresses.
- an address cannot be found in the correct register.

Error Code 2:



Passive Bus Error: this code appears when:
- the fault finding module cannot detect the ECU: in this case the CAN Bus is open.
- the CAN_hi and CAN_lo run time bus connection is reversed between the source (ECU) and the fault finding module.

Error Code 3:



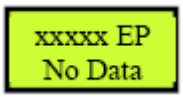
This code is the result of the following problems:
- the CAN_Hi or CAN_lo bus, or both, are connected to an electrical ground or an external source of current.

- data is being not transmitted at a standard baud rate.

This type of fault generally requires repairs to be carried out on the CAN BUS connection and therefore involves work on the engine wiring harness, i.e. on the fault finding module extension.

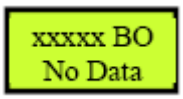
Run Time Bus Errors:
Fault codes can only be active if the fault finding module has been able to obtain the network addresses when it was switched on, see Address Claim Procedure Errors (ACP-err).

Error Code 1:



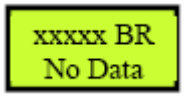
EP=Passive Error, this screen appears when the fault finding module loses contact with the ECU, there may be two causes of this:
- one connector on the bus connection is disconnected.
- the CAN Bus is open.

Error Code 2:



BO=Bus Off, in this case, the case is identical to Error code 3 of the ACP.

Error Code 3:



BR=Bus Reset, this error code is similar to Error code 3 of the ACP, as are its causes. In this case the fault finding module has encountered problems on the CAN Bus and it tries to automatically re-establish the network connection.

6.3. Generator set with TELYS control panel

6.3.1 Control panel presentation

6.3.1.1. View of the front panel

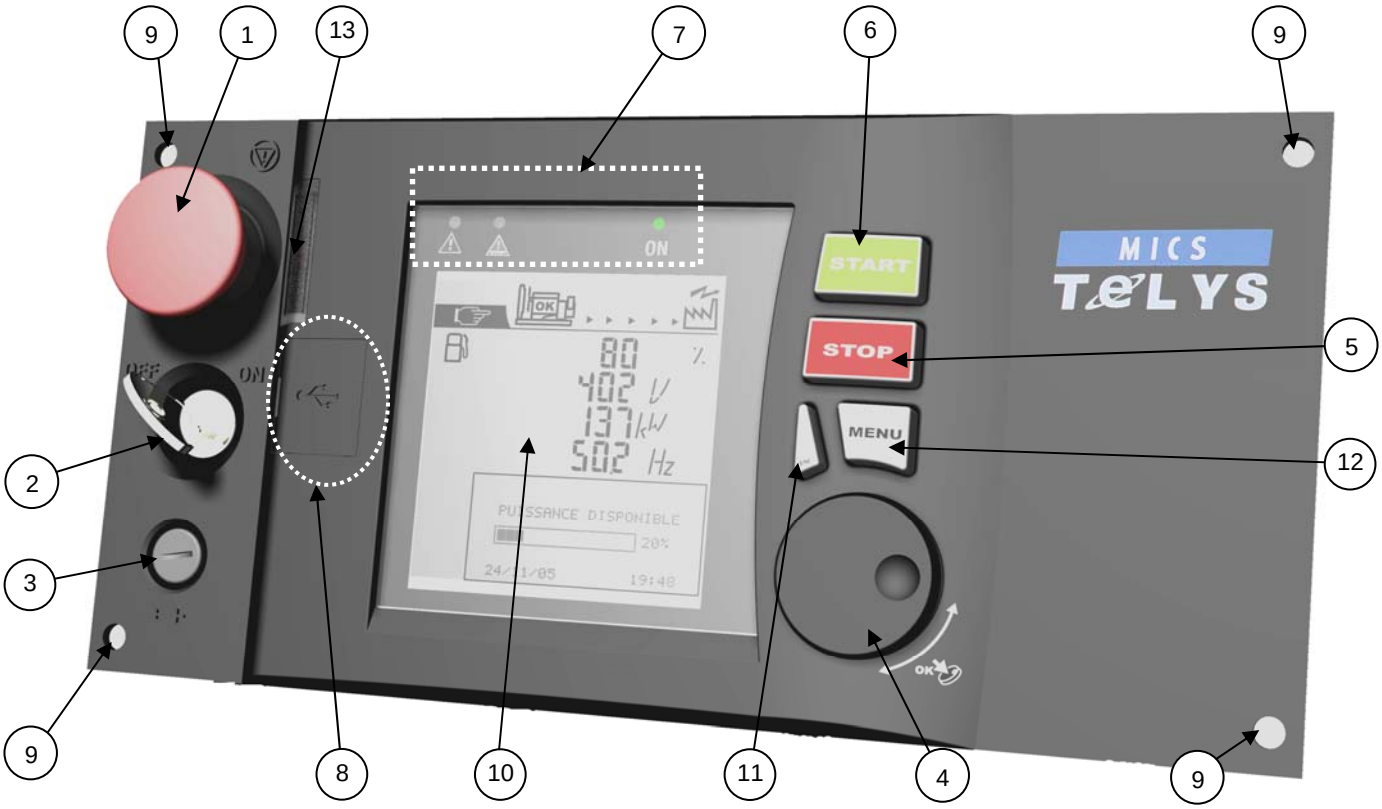


Fig. 6.4 - View of the front panel

1 Emergency stop button (AU) for switching off the generating set in the event of a fault which could endanger personnel or damage equipment.
2 Key switch for switching the module on/off.
3 Electronic board protection fuse.
4 Scrolling and selection wheel for scrolling through the menus and screens and selecting items simply by pressing the wheel.
5 STOP button, press to switch off the generating set.
6 START button, press to switch on the generating set.
7 Power ON LEDs and alarm/fault warning LEDs.
8 Location of USB ports.
9 Mounting bolt.
10 LCD for displaying alarms and faults, operating statuses, electrical and mechanical quantities.
11 ESC button: for returning to the previous selection and for default RESET function.
12 MENU button for accessing the menus.
13 Lighting for the emergency stop button.

Fig. 6.5 – Description of the LEDs

A lit LED indicates:
1 Alarm activated (flashing yellow).
2 Fault found (flashing red).
3 Module on (green, on continuously).

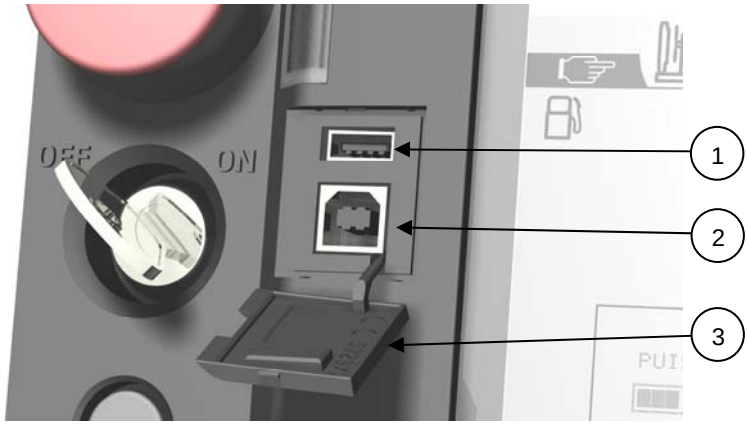


Fig. 6.6 – Close-up of USB ports

1 USB key connection (HOST): file transfer between USB key and TELYS and vice versa.
2 Connection for microcomputer (DEVICE):
- file transfer between PC and TELYS and vice versa,
- main module power supply.

3 Protective cover.

6.3.1.2. Description of the screen

The screen is backlit and requires no contrast adjustments. This screen is divided into 4 zones.

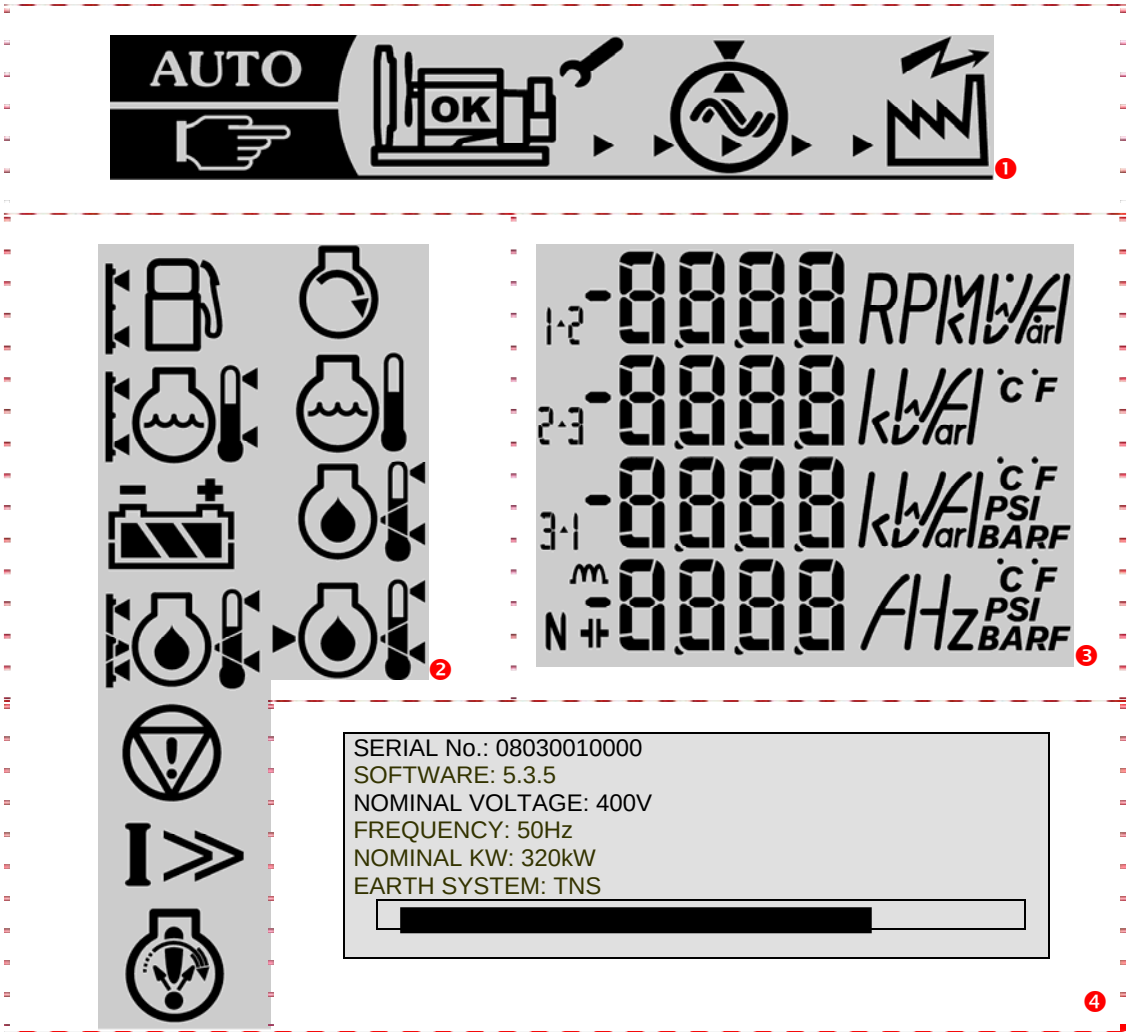


Fig. 6.7 – description of the screen (example)

❶ Zone 1: in this zone, the status of the generating set is displayed
❷ Zone 2: in this zone, pictograms relating to dimensions measured are displayed, as well as Alarm and Fault pictograms
❸ Zone 3: in this zone, the measured values corresponding to the measured dimensions are displayed with the corresponding units of measurement
❹ Zone 4: in this zone, messages relating to the control of the generating set and the menus are displayed.

Note: the information displayed on measurements, alarms and faults as well as messages and menus relating to control of the generating set will depend on the equipment level of each generating set. Certain screens may therefore not be present.

6.3.1.3. Description of the pictograms in zone 1

Pictograms in zone 1

Pictograms	Display	Activation conditions
"MANU" Mode	Fixed	TELYS in manual mode (MANU)
	Flashing	For 5 seconds when switching from AUTO mode to MANU mode
"AUTO" Mode	Fixed	TELYS in automatic mode (AUTO)
	Flashing	For 5 seconds when switching from MANU mode to AUTO mode
	Flashing	Generating set in start-up phase
	Fixed	Generating set started
	Fixed	Generating set stabilised (voltage and frequency)
	Flashing (appearance of constant movement from left to right)	The generating set is powering the installation
	Fixed	The installation is supplied
	Not used	
	Not used	

6.3.1.4. Description of the pictograms in zone 2

Alarm and fault pictograms in zone 2
All the pictograms in this zone are activated when TELYS is initialised.

Data displayed			
Fuel level indicator			
Alarm / Fault low fuel level		Alarm / Fault high fuel level	
Coolant level / temperature indicator			
Alarm Low level fault	High level fault alarm	Alarm High temperature fault	No preheating fault alarm
Battery			
Min battery voltage (flashing)	Max battery voltage (flashing)		Battery charge indicator (flashing bars)
Oil pressure / temperature indicator			
Oil pressure Alarm / Fault	High or low oil level Alarm / Fault	High or low oil temperature Alarm / Fault	
Emergency stop			
Emergency stop fault			
Overload or short circuit			
Tripping of circuit breaker following an overload or short circuit			
Engine speed			
Underspeed fault	Overspeed fault		Non-starting fault

6.3.1.5. Description of the pictograms in zone 3

Pictograms in zone 3

All the pictograms in these zones are activated when TELYS is initialised. The pictograms below are given as examples.

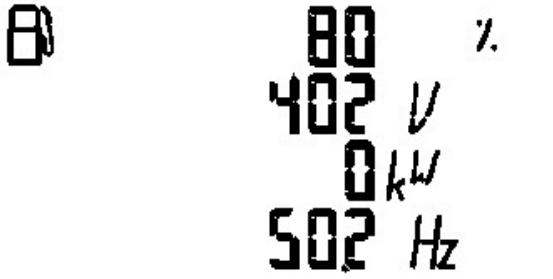
Generating set stopped

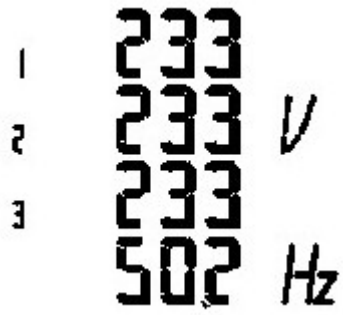
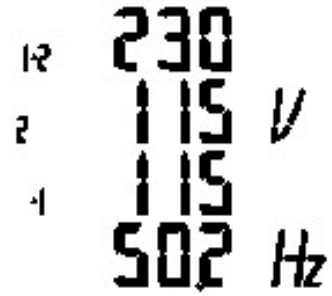
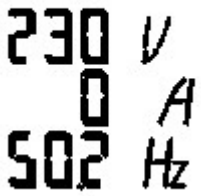
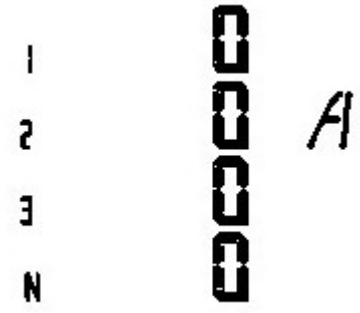
Screen no.	Pictograms	Data displayed
P1		Fuel Level Indicator Indication of Temperature of High Temperature coolant (HT) (units according to settings menu) Indication of Battery Voltage Indication of Oil Temperature (units according to settings menu)

Generating set start-up or generating set started or generating set switching off in progress

Screen no.	Pictograms	Data displayed
P2		Engine Speed Indication Indication of Temperature of High Temperature coolant (units according to settings menu) Indication of Oil Pressure (units according to settings) Indication of Oil Temperature (units according to settings menu)

Generating set started

Screen no.	Pictograms	Data displayed
P3 Default screen in operation		Fuel Level Indicator Alternator composite Voltage Indicator Total Active Power Indicator Alternator Frequency Indicator
P4		U12 Alternator composite Voltage Indicator U23 Alternator composite Voltage Indicator U31 Alternator composite Voltage Indicator Alternator Frequency Indicator

Screen no.	Pictograms	Data displayed
P5		V1 Alternator single Voltage Indicator V2 Alternator single Voltage Indicator V3 Alternator single Voltage Indicator Alternator Frequency Indicator
P6		U12 Alternator composite Voltage Indicator V2 Alternator single Voltage Indicator V1 Alternator single Voltage Indicator Alternator Frequency Indicator
P7		V1 Alternator single Voltage Indicator Single phase Alternator current indicator Alternator Frequency Indicator
P8		Single phase Alternator current indicator Two phase Alternator current indicator Three phase Alternator current indicator Neutral Alternator current indicator
P9		Total Active Power Indicator Total Reactive Power Indicator Total Effective Power Indicator Total Power Factor Indicator (lagging or leading)

Screen no.	Pictograms	Data displayed
P10		Fuel Level Indicator Indication of Battery Voltage Indication of Battery Amps

Screen order of appearance according to network type with the generating set on.

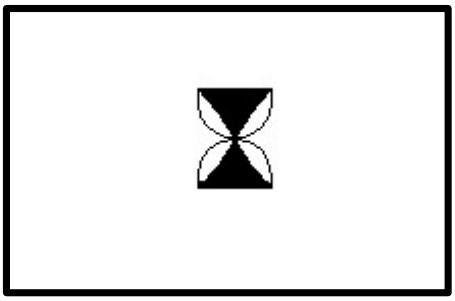
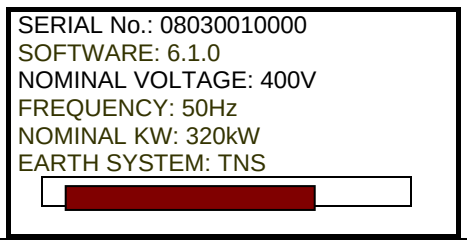
	Type of network			
Order of appearance	**3P+N**	**3P**	**2P+N**	**1P+N**
1	P3	P3	P3	P3
2	P4	P4	P6	P7
3	P5	P8	P8	P9
4	P8	P9	P9	P2
5	P9	P2	P2	P10
6	P2	P10	P10	
7	P10			

Change screens by using the scrolling and selection wheel.
When the wheel is rotated clockwise, the screens scroll upwards and vice-versa.
The screens scroll in a loop.
E.g.: On three-phase + neutral network, then screen 7, then screen 1 and vice-versa.

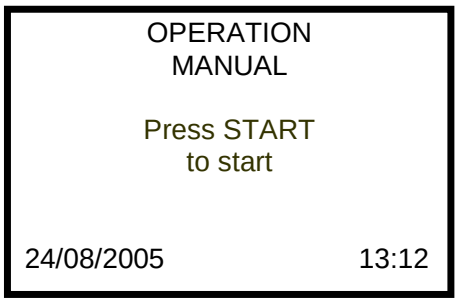
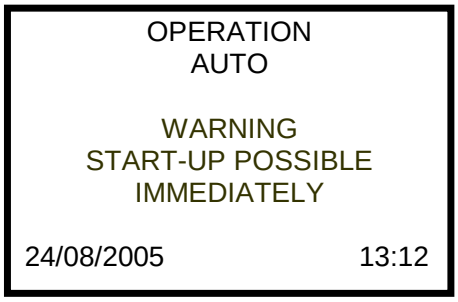
6.3.1.6. Display of messages in zone 4

The display (zone 4), among other things, displays messages relating to the operation of the generating set. The messages are as follows:

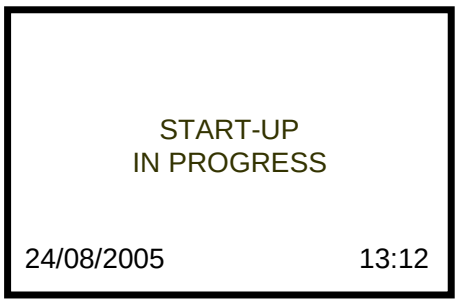
Initialisation of TELYS

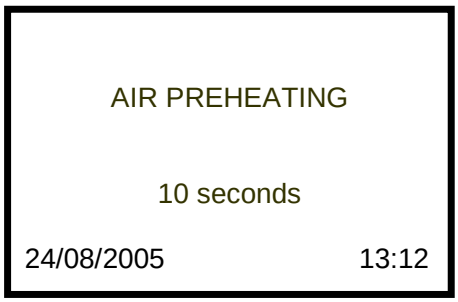
Screen no.	Screen	Data displayed
G 1		Initialisation of TELYS when the power is switched on and/or when loading a configuration
G 2		Generating set serial no. Software version of TELYS Alternator Nominal Voltage Alternator Nominal Frequency Nominal Active Output Neutral Point Bar graph indicating the display delay of the screen

Generating set stopped

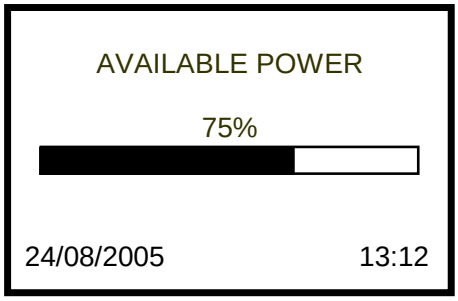
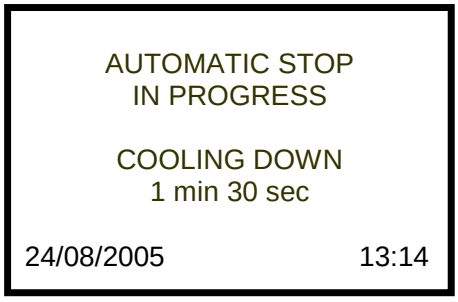
Screen no.	Screen	Data displayed
G 3		Operating mode - generating set in Manual Mode ready to start Date and time (depending on settings)
G 4		Operating mode - generating set in Auto Mode ready to start Date and time (depending on settings)
G 5		Operating mode - generating set in Auto Mode with programmed start Countdown to micro disconnection delay or EJP notice delay (for France only) Date and time (depending on settings)

Generating set start-up

Screen no.	Screen	Data displayed
G 6		Operating phase - generating set in starting phase Date and time (depending on settings)

Screen no.	Screen	Data displayed
G 7		Operating phase - air preheating prior to starting generating set Countdown for air preheating delay Date and time (depending on settings)

Generating set started

Screen no.	Screen	Data displayed
G 8 Default screen		Operating phase – generating set in operation – stable voltage and frequency Available power Date and time (depending on settings)
G 9		Operating mode - operation in Auto Mode Opening of power supply device (motorised circuit breaker or source changeover switch controlled by TELYS) Countdown for the mains return delay OR the load test delay Date and time (depending on settings)
G 10		Operating mode - operation in Auto Mode Generation set cooling in progress Countdown for Engine Stop delay (cooling) OR Gradual Stop delay (Coolant temperature) OR Overload Gradual Stop delay OR OFF load test delay Date and time (depending on settings)

Generating setstop

Screen no.	Screen	Data displayed
G 11	OFF IN PROGRESS 24/08/2005 13:16	Generating set stop in progress Date and time (depending on settings)

Operating mode changeover (switching from Manual Mode to Auto Mode following auto start demand)

Screen no.	Screen	Data displayed
G 12	Start Demand AUTO Do you wish to change to Auto Mode? WARNING Immediate start OK Esc	Operating mode - operation in Manual Mode AUTOMATIC start demand

Generating set stop request due to fault or by pressing STOP in Auto Mode

Screen no.	Screen	Data displayed
G 13	Manual Mode activated Do you wish to change to AUTO mode? OK Esc	Operating mode - operation in Auto Mode (generating set in operation) Warning message for switching to Manual Mode after the STOP button has been pressed or a fault has appeared

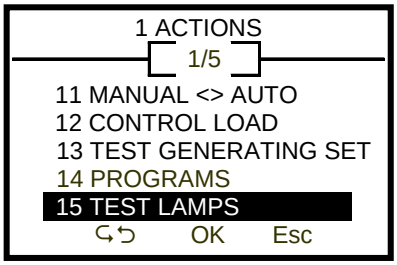
6.3.2 Starting

Danger	Check that the generating set circuit breaker has triggered.

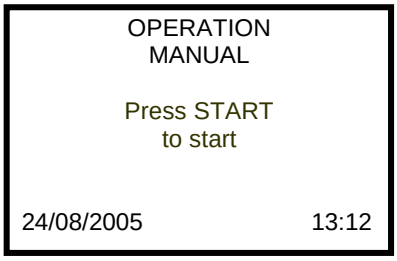
❶ Connect the generating set battery

❷ Turn the key switch to the ON position (without forcing it to the ON position), the ON lamp will light up (if the lamp does not light up, check and replace the fuse if necessary)

❸ Test the Alarm and Fault LEDs (menu 15 – TEST LAMPS)

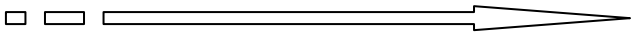


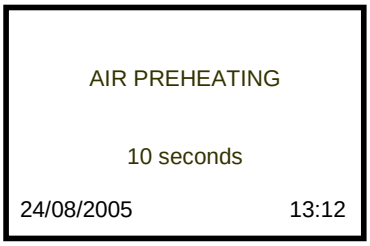
❹ Press "Esc" several times to return to the following home menu



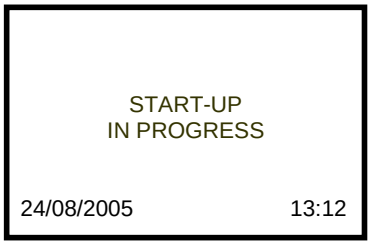
❺Check the battery voltage

❻ Press START:



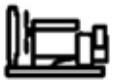


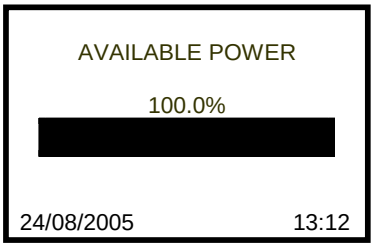
- If the engine is equipped with an air preheating system, there is a delay (adjustable) before the engine starts (preheating activation period).
- If the motor is not fitted with an air preheating system or once the preheating delay has elapsed, the engine starts up (start of a cycle comprising 3 attempts to start up the engine).



Warning: the number of successive and automatic starting attempts is limited to 3.

The following pictogram will flash





The following pictogram is displayed

The following information is displayed

	Speed of rotation	
	Coolant temperature	Options
	Oil pressure	
	Oil Temperature	

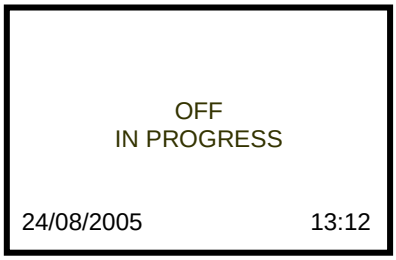
6.3.3 Switching off

❶ Open the circuit breaker
- manually OR
- by selecting menu 12 "CONTROL LOAD"

The following display will disappear (supply stopped)

❷ Press the STOP button

❸ The following screen is displayed and the generating set will stop



❹ Switch TELYS off by turning the key to "OFF" (without forcing it to the "OFF" position).

6.3.4 Alarms and faults

6.3.4.1. Viewing alarms and faults

Alarms and faults are displayed as follows:

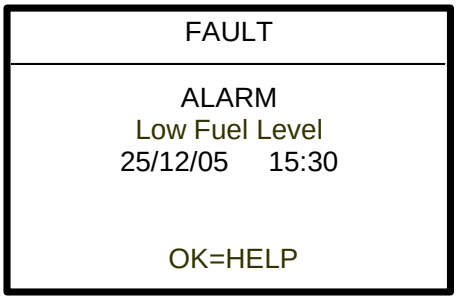
① Alarms

All alarms will cause:

- the yellow LED to flash "General alarm".

In conjunction with this LED:
- a flashing pictogram appears on the LCD screen representing the circuit affected by the alarm and the associated indicator, if present (example)

- message on graphic display (example)



② Faults

All faults will cause:

- **the generating set to stop: immediate or gradual stop (coolant temperature and overload or short circuit)**
- the red LED to flash "General fault".

In conjunction with this LED:

- a flashing pictogram appears on the LCD screen representing the circuit affected by the fault and the associated indicator, if present (example)

- message on graphic display (example)

FAULT
FAULT Oil Pressure 25/12/05 15:30 OK=HELP

Faults have priority over alarms. Faults are displayed in the descending order of their appearance (from the most recent to the oldest).

6.3.4.2. Activation of an alarm or fault

The appearance of an alarm **or** a fault causes the corresponding screen to be displayed (examples below)

FAULT
ALARM Low coolant Level 06/10/06 10:30 OK=HELP

FAULT
FAULT Emergency Stop 06/10/06 15:30 Esc=RESET OK=HELP

Press OK (on the scrolling and selection wheel) to access the help message if it is available (example below)

HELP
Check the level fuel Esc=EXIT

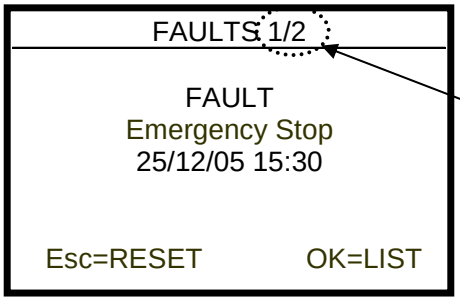
If the alarm is no longer active, it is reset automatically (cause disappears).
Press Esc to reset a fault:

- reset acknowledged if the cause of the fault has been removed
- reset not performed if the cause of the fault is still present.

6.3.4.3. Activation of an alarm and a fault

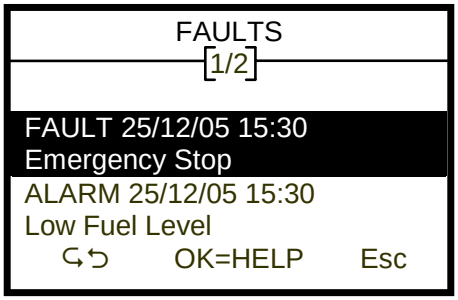
The appearance of an alarm **and** a fault causes:

- The yellow and red LEDs to flash
- the related screen to be displayed (example below)

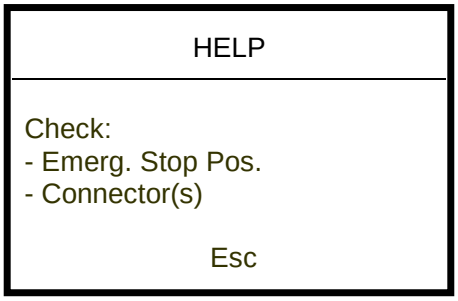


If several faults are present, the number of faults is displayed at the top of the screen.

The faults list can be accessed by pressing OK (of the scrolling and selection wheel) (examples below)



Press Esc to return to the previous screen.
Press OK to go to the HELP screen (help on the highlighted fault)
Use the scrolling and selection wheel to scroll through the list of faults.



If the alarm is no longer active, it is reset automatically (cause disappears).
Press Esc to reset a fault:

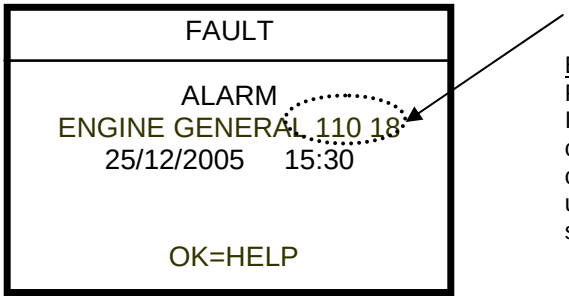
- reset acknowledged if the cause of the fault has been removed
- reset not performed if the cause of the fault is still present.

6.3.4.4. Engine fault codes display

Certain alarms and engine faults generate specific fault codes. These codes are standardised according to the J1939 and/or J1587 standards.

Terminology used by the SAE CAN J1939 standard	
SPN: Suspect Parameter Number	This represents the system or component at fault, for example: SPN 100, indicates an oil pressure problem or a problem with the oil pressure sensor.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault.
Terminology used by VOLVO	
SID: System Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). However, this term corresponds, more particularly, to an assembly of components, for example, the injection system.
PID: Parameter Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). However, this term corresponds, more particularly, to a specific component, for example, a sensor.
PPID: Parameter Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). PPID corresponds to PID, but is only used by VOLVO.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault. VOLVO uses a SID-FMI or PID-FMI or PPID-FMI combination.
Terminology used by JOHN DEERE	
SPN: Suspect Parameter Number	This represents the system or component at fault, for example: SPN 100, indicates an oil pressure problem or a problem with the oil pressure sensor.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault.

In the event of a fault, the screen will display the following message:



Engine fault code.
Pressing OK will display fault finding information.
In addition, appendix D indicate the meaning of the code. The checking and maintenance operations to carry out in order to solve the fault are included in the user and maintenance manuals of the engines supplied with the generating set documentation.

For JOHN DEERE (JD) and VOLVO (VO) engines, the codes displayed are SPN and FMI codes.

6.3.4.5. Horn reset

Depending on the settings made (menu 363 - HORN), the activation of an alarm and/or a fault leads to the horn sounding and the following screen appearing:

This screen will display first any messages relating to the alarms and faults that appear as soon as OK is pressed.

7. Maintenance schedule

7.1. Reminder of use

The maintenance interval frequency and the operations to be carried out are outlined in the maintenance schedule, given as a guideline.
N.B. the environment in which the generating set is operating determines this schedule.
If the generating set is used in extreme conditions, shorter intervals between maintenance procedures should be observed
These maintenance intervals only apply to generating sets running on fuel, oil and coolant which conform to the specifications given in this manual.

7.2. Maintenance safety instructions

Before each operation, please observe the following maintenance safety instructions:

- ✓ read the safety instructions carefully (chapter 1),
- ✓ refer systematically to the maintenance instructions,
- ✓ the battery isolating switch must be in the open position,
- ✓ no operations must be carried out while the motor is running,
- ✓ wear protective equipment (gloves, goggles, safety shoes etc.),
- ✓ before operating on a pressurised circuit, ensure that the circuit pressure has been reduced (atmospheric pressure),
- ✓ after the operations, ensure that the equipment is clean, or clean it if necessary.

7.3. Table of maintenance operations

OPERATIONS	10 h Daily	Every 2 weeks	500 h	1000 h 1 years	2000 h 2 years	4500 h	5000 h	10 000 h	20 000 h 3 years
Generator set									
• Check the general condition				●					
• Check the tightening torques				●					
• Check the absence of leaks			●						
• Check the condition of battery charge			●						
• Clean the battery terminals			●						
• Check condition and connections of electrical equipment			●						
• Clean with compressed air the relays and contactors			●						
Engine									
• Check engine oil and coolant level	●								
• Check air filter restriction indicator[a]	●								
• Check fuel filter / Water bowl	●								
• Operate engine at rated speed and 50-70% load a minimum of 30 minutes [b]		●							
• Change engine oil and filter[c]			●						
• Replace fuel filter element(s)			●						
• Check crankcase vent system			●						
• Check engine mounts			●						
• Check engine ground connection			●						
• Check belt tension and automatic tensioner				●					
• Check cooling system				●					
• Check air intake system				●					
• Replace crankcase vent filter (Optional)				●					
• Check crankshaft vibration damper (6cyl.)[d]				●					
• Check and adjust engine speed				●					
• Drain and flush cooling system[e]					●				
• Adjust valve clearance					●				
• Replace crankshaft vibration damper (6cyl.)						●			
• Replace injection nozzles							●		
• Replace thermostat								●	
Alternator									
• Check the tightening torques	After the first 20 hours								
• Check the general condition									
• Check the various electrical connections of the installation									
• Grease the bearings									●

[a] Clean air filter element when restriction indicator is red. Replace filter element after 6 cleanings or once a year.

[b] For standby generator set only.

[c] Change oil and filter after the first 100 hours of operation, then every 500 hours maximum thereafter. Change oil and filter at least once a year.

[d] Have your authorized dealer or engine distributor replace the vibration damper every 4500 hours / 5 years.

[e] Drain and flush cooling system every 3000 hours / 3 years when John Deere COOL-GARD II coolant isused. Otherwise every 2000 hours / 2 years.

7.4. Common Spare Parts

GenPARTS

R90C3
Rental Power

JOHN DEERE 4045HFS86

ENGINE

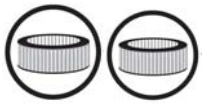
Rocker cover gasket	330362994	x 1
Fuel injector	330362947	x 4
Belt	330364761	x 1
Thermostat	330364770	x 1
Thermostat Gasket	330361286	x 1
Flywheel turning tool	330360151	x 1
Timing pin	330361548	x 1
Feeler gauge	330030850	x 1

GENLUB

x 20 L	330910115	X 1
x 208 L	330910095	

GENCOOL

x 20 L	330910098	X 1
x 60 L	330910099	
x 210 L	330910100	

	330570115 + 330570116	x 1
	330362912 + 330362934	x 1
	330560661	x 1

LEROY-SOMER LSA43.2L8

ALTERNATOR

Bearing grease	330411113	x 1
Bearing	330410336	x 1

For any need of spare parts, please contact:

Spare Parts department
✆ : +33(0)02.98.41.13.07
e-mail :genparts@sdmo.com

To find your nearest center service, please consult our website:

www.sdmo.com

7.5. Fault finding

Refer to the user manual and engine and alternator maintenance manuals appended.

Additionally, in the event of an abnormal rise in engine temperature, check that the radiator is clean.

7.6. No load and under load tests

Notes on operation at no load and under load:

When operating at no load or low load (< 30% of nominal power), the operating conditions do not allow optimum running of the engine. The main causes are as follows:

- ✓ The low volume of fuel burned in the combustion chamber leads to incomplete combustion; the resulting thermal energy means that the optimum engine operating temperature cannot be reached.
- ✓ Overheated engines have lower compression ratios (low compression ratio without turbocharging), which are defined for full load and not suitable for good combustion at low load.

All of these factors lead to choking of the engine, in particular the piston rings and valves, which leads to:

- ✓ Accelerated wear and glazing of the cylinder liners
- ✓ Loss of sealing of seats, and sometimes sticking of valve stems.

Consequently, operating any turbocharged engine at low load (< 30%) can only have adverse repercussions on an engine's operation and its service life. Maintenance intervals will have to be shortened to accompany harsh operating conditions. Shortening draining intervals, among other things, will enable you to change the oil more frequently, which will tend to be choked with unburnt particles and contaminated with fuel. Adding a load bench is generally used to limit low load phases, and obtain the periodic full loads necessary to unchoke the engine.

Finally, when operating under load, we advise vigilance towards the oil breather circuit, and more particularly towards engines which have the crankcase vent connected to the turbocharger inlet (risk of oil or oil vapour absorption and accelerated engine speed).

On load tests:

It is recommended to conduct an on load test on the generating set monthly, for a period of around 1 hour after stabilisation of the parameters.

The load must be greater than 50% of nominal power (ideally 80%), to ensure unchoking of the engine and to obtain a decent picture of the generating set operation.

Off load test (no load):

This test is not recommended; it must not exceed 10 minutes, and must not be repeated without a monthly on load test. This test only allows you to check for correct engine start-up. It does not allow you to check that the generating set is working properly.

8. Battery

	Fit the battery so that it is properly ventilated. Maintenance should only be carried out by qualified personnel. If replacing the batteries, use the same type of batteries. Do not throw the old battery in the fire. Only use insulated tools (the operator should not be wearing a watch, chain or any metal object). Never use sulphuric acid or acid water to top up the electrolyte level. Use an approved battery fluid. Batteries release oxygen and hydrogen gas, which are flammable. Never bring flames or sparks near the battery (risk of explosion). Discharge any static electricity before handling the batteries by first touching an earthed metal surface. Do not use the battery when the fluid level is below the minimum required level Using a battery with a low electrolyte level could result in an explosion. Do not short the battery terminals with a tool or other metal object. When disconnecting battery cables, remove the cable from the negative (-) terminal first. When reconnecting the battery, connect the positive lead (+) first. Charge the battery in a well-ventilated place, with all the filler caps opened. Ensure that the battery terminals are correctly tightened. A loose cable clamp can cause sparks that could result in an explosion.
Danger	Before servicing electrical components or performing electric welding, set the battery switch to the [OFF] position or disconnect the battery negative cable (-) to cut off the electrical current. Electrolyte contains dilute sulphuric acid. Careless handling of the battery causing contact with sulphuric acid could damage your eyesight or cause burns. Wear safety goggles and rubber gloves when working with the battery (topping-up fluid, charging, etc.) If electrolyte comes into contact with your skin or clothes, wash it off immediately with plenty of water, then carefully wash the area with soap. If electrolyte comes into contact with your eyes, rinse immediately with plenty of water and seek medical attention as soon as possible. If electrolyte is accidentally swallowed, gargle with plenty of water and drink large quantities of water. Consult a doctor immediately. Large quantities of electrolyte should be rinsed off using a neutralising agent. A common method is to use a solution of 500g of bicarbonate of soda diluted in 4 litres of water. The bicarbonate of soda solution should be added until the reaction has finished (lather). The remaining liquid should be rinsed off with water and left to dry.

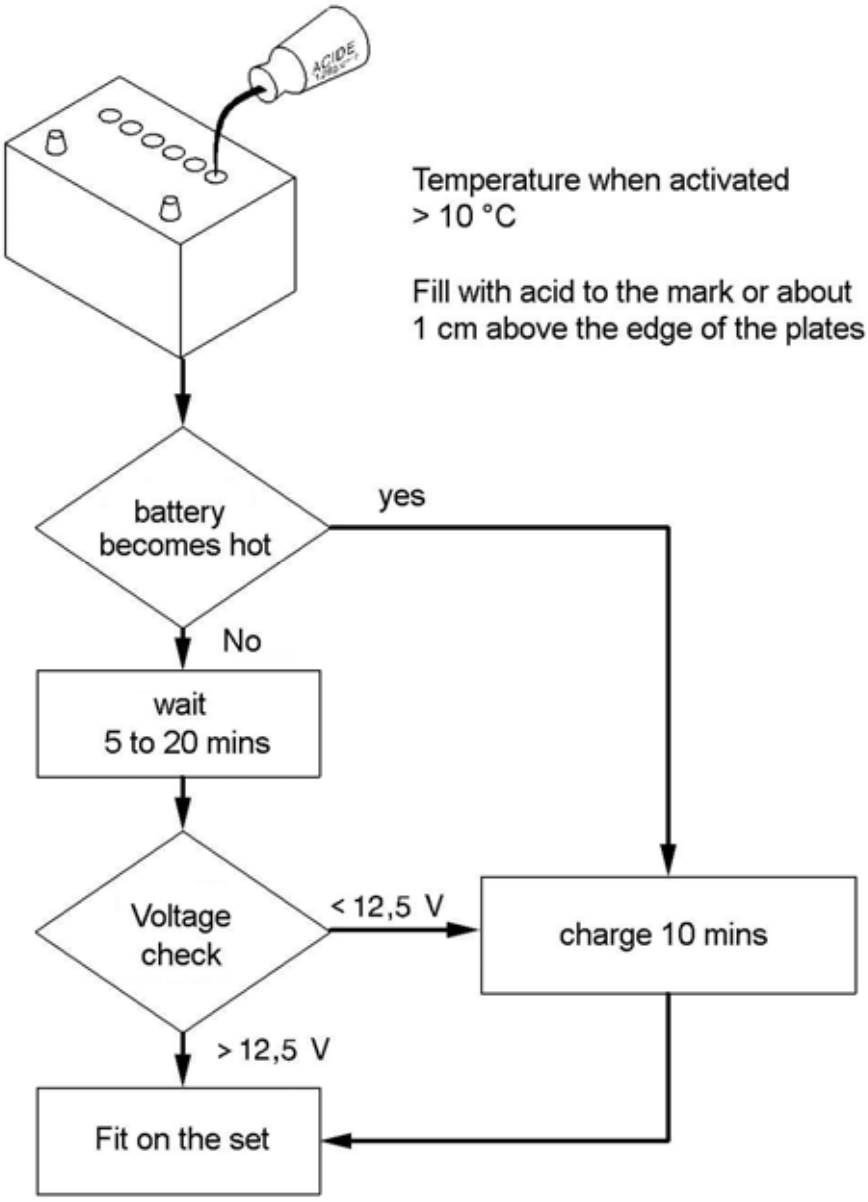
- ✓ Dry batteries do not require any servicing
- ✓ Batteries ready for use must be recharged at the latest when the acid density drops below 1.20.

8.1. Storage and transport

- ✓ Batteries ready for use must be stored in a cool and dry place (frost-free) protected from the sun (self-discharge).
- ✓ Batteries must be transported and stored vertically (risk of acid spillage)
- ✓ Leave the terminal cover on the positive terminal

8.2. Battery setting into service

- Batteries filled with acid have a density of 1.28 g/ml and are charged.
- In the case of dry batteries, fill each battery cell with acid up to the maximum level mark or to 15 mm above the plates. Let the battery rest for 20 minutes.
- Before fitting the battery, stop the engine and any power consumer, clean the terminals and give them a light coating of grease. When connecting, connect the positive terminal (+) first, and then the negative terminal (-).



8.3. Check

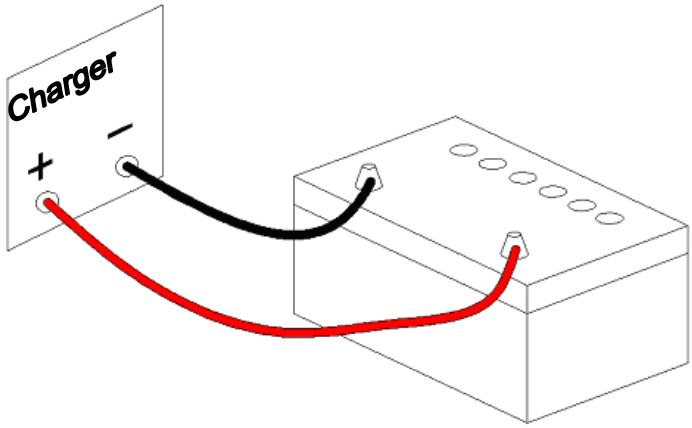
Acid density	Charge status	Voltage when idle	
1.27	100%	Above 12.60 V	
1.25	80%	12.54 V	
1.20	60%	12.36 V	**From 50 % recharge**
1.19	40%	12.18 V	**Risk of sulphation**
1.13	20%	Under 11.88 V	**Unusable**

8.4. Load preconization

✓ Highly discharged or sulphated batteries (formation of whitish lead sulphate deposit on the plates, which becomes hard and insoluble to acid; this deposit reduce the active surface of the plates, and increases their internal resistance) can no longer regenerate or be charged in a generating set.

Important	A discharged battery should be recharged immediately, or else it will suffer irreparable damage.

Battery charge



When several batteries are connected together, the following points should be checked:
✓ Are the batteries connected in series?
✓ Has the correct voltage been chosen? 1 battery x 12 V , 3 x 36V batteries.
✓ Adjust the charge current to the lowest battery.
✓ The power difference between the batteries must be as low as possible.

Example of charge:
✓ 12V 60 Ah battery = charging current 6 A.
✓ Charge status: 50% (acid density 1.21/voltage when idle 12.30V).
✓ The battery is short 30 Ah, and this must be recharged.
✓ Charge factor: 1.2.
✓ Ah x 1.2 = 36 Ah to be charged.
✓ Charging current: 6A approximately 6 hours charging required.

Recharging is complete when the battery voltage and the acid density stop increasing.

→ The charging current must always be $1/10^{th}$ of the nominal capacity of the battery.

The power of the charger must be suitable for the battery to be charged and the charging time available.
You need to use an automatic charger able to provide a sufficient voltage and charging current, as well as a compensation voltage to handle spontaneous battery discharge.

8.5. Faults and remedies

Fault observed	Probable origin	Measures or observations
The acid heats up when a new battery is filled	- Incorrect composition - Incorrect storage - Prolonged storage in a damp place	- Cool - Load - Check the acid density
The acid escapes through the filler holes	- Overfilled battery	- Reduce the battery fluid level
Acid level too low	- Battery tray not leaktight - Excessive charge voltage leading to a significant accumulation of gas.	- Replace the battery - Check the charger and repair if necessary.
Acid level too low Incorrect operation from start-up	- Insufficient charge - Short circuit in the power circuit - Consumption fault	- Recharge - Check the electrical installation
Acid density too high	- The battery has been filled with acid instead of battery fluid	- Reduce the acid level by filling with distilled water. Repeat the operation if necessary.
Starting problems Starting test incorrect	- Battery empty - Battery exhausted or faulty - Capacity too low - Battery sulphated	- Recharge the battery - Fit a new battery
Battery terminals melted	- Incorrect electrical connection - Battery cabling incorrect	- Tighten the ends of the battery cables, or replace them if necessary
One or two cells release a lot of gas at high charge	- Cell(s) faulty	- Fit a new battery
The battery discharges very quickly	- Charge status too low - Short circuit in the current circuit - High self-discharge (through electrolyte contamination etc.) - Sulphation (storage of discharged battery)	- Check the load - Replace the battery
Short service life	- Incorrect battery part no. - Repeated deep discharging - Battery stored too long without charge	- Define the correct battery part no. for the recommended use - It is recommended to charge the battery using a regulator
High water consumption	- Overload - Charging voltage too high	- Check the charger (voltage regulator)
The battery explodes	- Spark after battery charging - Short circuit - Connection or disconnection during charging - Internal fault and low electrolyte level	- Replace the battery - Ventilate well

9. Appendix

9.1. Appendix A – Engine user and maintenance manual

User guide and maintenance manual

JOHN DEERE

Engine

4045HFS86
4045HFS87
4045HFS88

6068HFS85
6068HFS86

OMCD16510
23/12/2010

33522921101_0_1

Engines & Power Units for Generator Sets Stage III A (Saran-Built)

OPERATOR'S MANUAL

Engines & Power Units for Generator Sets Stage III A (Saran-Built)

OMCD16510 ISSUE L0 (ANGLAIS)

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

If this product contains a gasoline engine:

⚠ WARNING

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

The State of California requires the above two warnings.

Additional Proposition 65 Warnings can be found in this manual.

John Deere Usine De Saran

European Edition
PRINTED IN GERMANY

Foreword

THIS MANUAL COVERS the following Stage III A engines for generator sets:

Engine Pack

CD3029TFU80 (Mechanical Fuel System)
CD4045HFU82 (HPCR System, 2-Valve Head)
CD6068HFU82 (HPCR System, 2-Valve Head)
RG6090HFU84 (HPCR System, 4-Valve Head)

Bare Engine

CD4045HFS86 (HPCR System, 2-Valve Head)
CD4045HFS87 (HPCR System, 2-Valve Head)
CD4045HFS88 (HPCR System, 2-Valve Head)
CD6068HFS85 (HPCR System, 2-Valve Head)
CD6068HFS86 (HPCR System, 2-Valve Head)

READ THIS MANUAL carefully to learn how to operate and service your engine correctly. Failure to do so could result in personal injury or equipment damage.

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your engine and should remain with the engine when you sell it.

MEASUREMENTS IN THIS MANUAL are given in metric. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

WRITE ENGINE SERIAL NUMBERS and option codes in the spaces indicated in the Serial Number Section. Accurately record all the numbers. Your dealer also needs these numbers when you order parts. File the identification numbers in a secure place off the engine or machine.

RIGHT-HAND AND LEFT-HAND sides are determined by standing at the drive or flywheel end (rear) of the engine and facing toward the front of the engine.

SETTING FUEL DELIVERY beyond published factory specifications or otherwise overpowering will result in loss of warranty protection for this engine.

Information relative to emissions regulations
Depending on final destination, this engine can meet the emissions regulations according to the US Environmental Protection Agency (EPA), California Air Resources Board (CARB) and for Europe, the Directive 97/68/EC relating the measures against the emissions of gaseous and particulates pollutants from internal combustion engines. In this case an emission label is stuck on the engine.

Emission regulations prohibit tampering with the emission-related components listed below which would render that component inoperative or to make any adjustment on the engine beyond published specifications. It is also illegal to install a part or component where the principal effect of that component is to bypass, defeat, or render inoperative any engine component or device which would affect the engine conformance to the emissions regulations. To summarize, it is illegal to do anything except return the engine to its original published specifications.

List of emission-related components:
- Fuel injection pump
- Intake manifold
- Turbocharger
- Charge air cooling system
- Piston

CALIFORNIA PROPOSITION 65 WARNING

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

CD03523,0000293 -19-23DEC10-1/1

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Original Instructions. All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

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A John Deere ILLUSTRUCTION ® Manual

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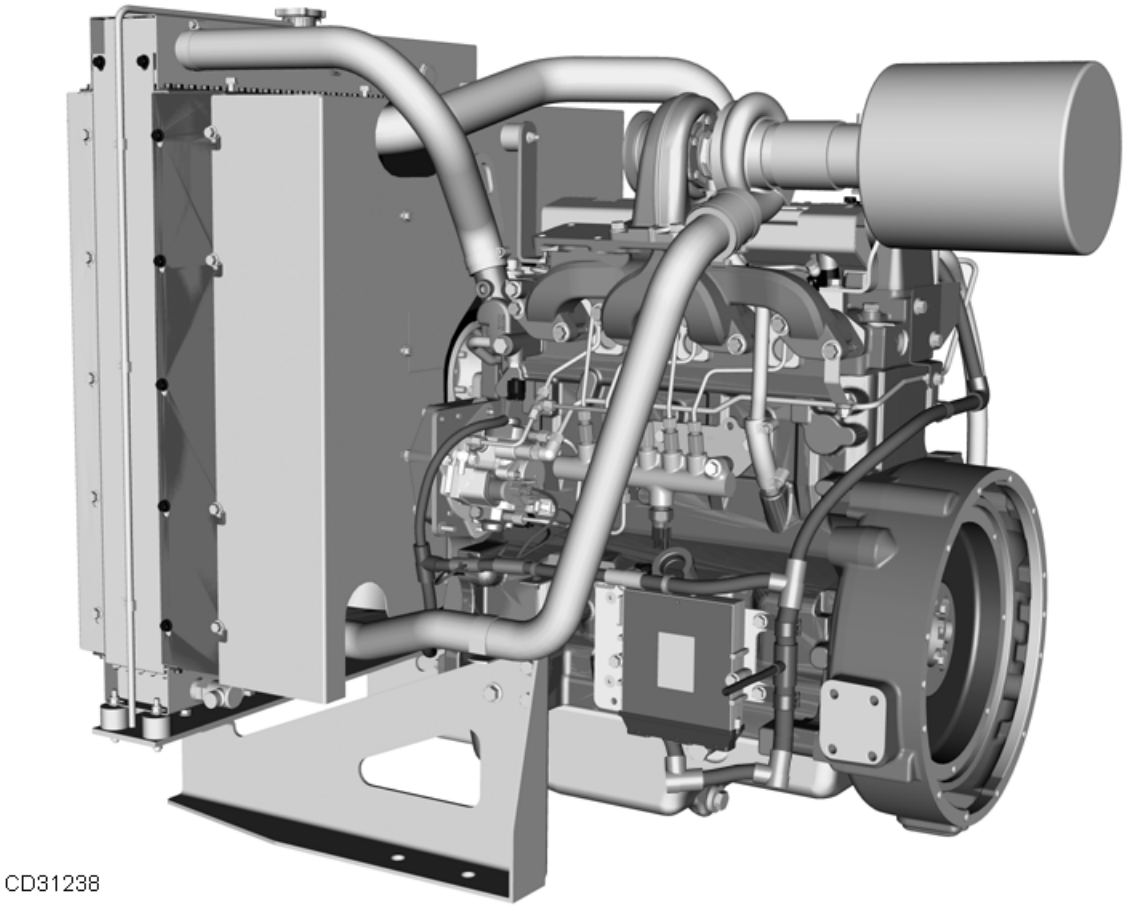
Identification Views



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4045HFU82

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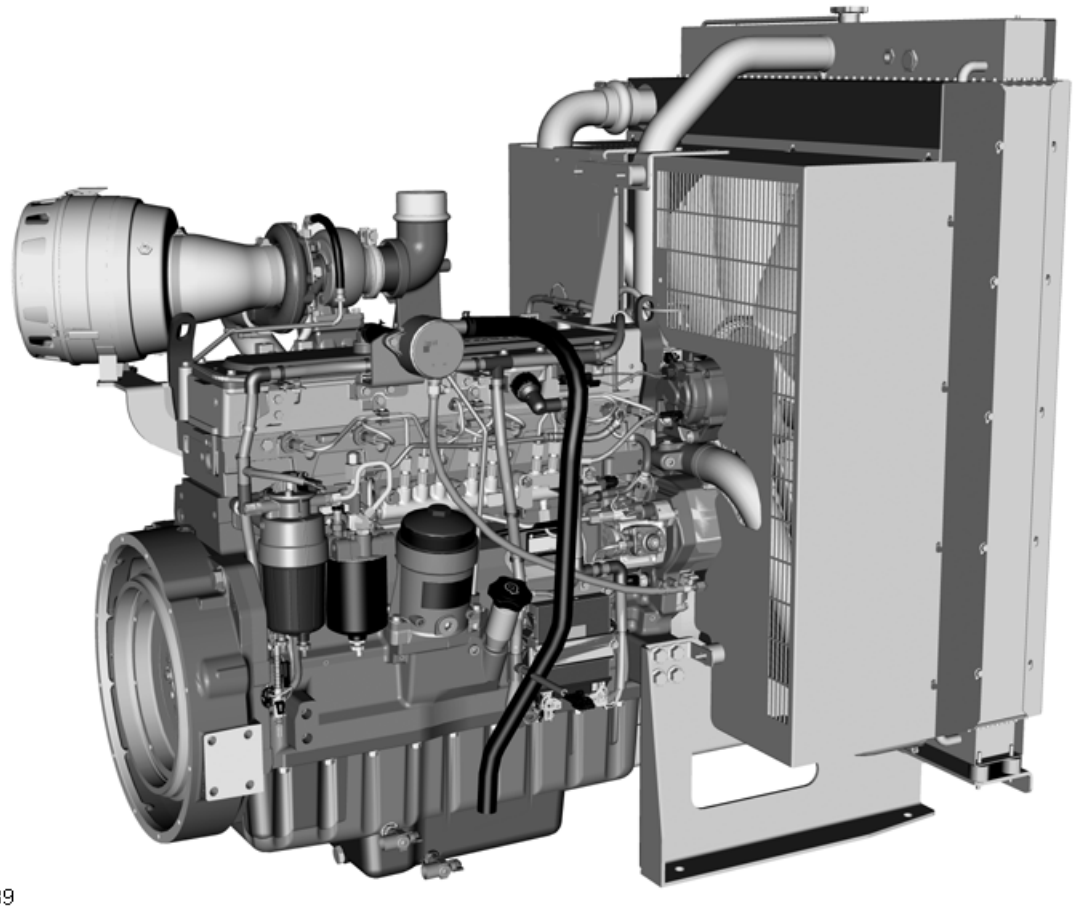

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6090HFU84

CD03523,0000294 -19-04NOV10-2/2

Maintenance Records

Using maintenance records

To obtain the best performance, economy and service life from your engine, ensure service is carried out according to this present manual and recorded in the following pages. It is recommended that your engine Distributor or your Dealer carry out this service work and stamp the appropriate case.

Keeping an accurate account of all service performed on your engine will give more value to the machine when resell it.

John Deere oils and coolants have been formulated to give maximum protection and performance to your engine. We recommend only genuine John Deere service products and replacement parts.

To protect your rights under the warranty ensure all scheduled services are carried out and recorded. If your engine is covered by extended warranty, it is important to maintain this record for the duration of the warranty.

DPSG,CD03523,6 -19-22JAN07-1/1

100 Hours of operation

□ Engine oil, drain □ Engine oil filter, replace □ Hose connections, check	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,7 -19-22JAN07-1/1

500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,0000295 -19-22DEC10-1/1

1000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,0000296 -19-03JAN11-1/1

1500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,0000297 -19-22DEC10-1/1

2000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check or drain and flush (if COOL-GARD II is not used)	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	□ Valve clearance, adjust

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,0000298 -19-03JAN11-1/1

2500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,0000299 -19-22DEC10-1/1

3000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check or drain and flush (if COOL-GARD II is used)	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,000029A -19-03JAN11-1/1

3500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,000029B -19-22DEC10-1/1

4000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check or drain and flush (if COOL-GARD II is not used)	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	□ Valve clearance, adjust

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,000029D -19-03JAN11-1/1

4500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,000029E -19-22DEC10-1/1

5000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,000029F -19-03JAN11-1/1

5500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A0 -19-22DEC10-1/1

6000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, drain and flush	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	□ Valve clearance, adjust

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A1 -19-03JAN11-1/1

6500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A2 -19-22DEC10-1/1

7000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A3 -19-03JAN11-1/1

7500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A4 -19-22DEC10-1/1

8000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check or drain and flush (if COOL-GARD II is not used)	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	□ Valve clearance, adjust

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A5 -19-03JAN11-1/1

8500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A6 -19-22DEC10-1/1

9000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, replace
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check or drain and flush (if COOL-GARD II is used)	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A7 -19-03JAN11-1/1

9500 Hours of operation

□ Engine oil, drain	□ Crankcase vent system, clean
□ Engine oil filter, replace	□ Engine mounts, check
□ Fuel filter elements, replace	□ Engine ground connection, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A8 -19-22DEC10-1/1

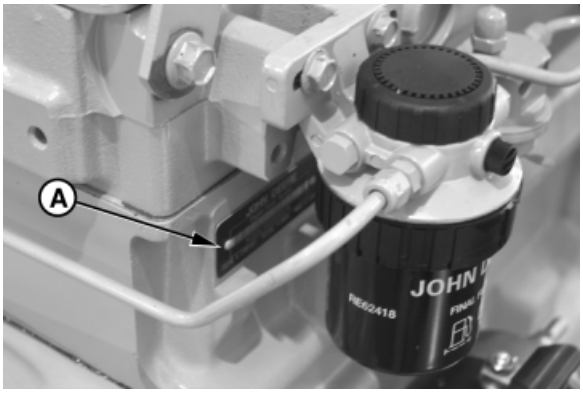
10000 Hours of operation

□ Engine oil, drain	□ Air intake system, check
□ Engine oil filter, replace	□ Crankshaft vibration damper, check
□ Fuel filter elements, replace	□ Engine mounts, check
□ Belt, check tension and wear	□ Engine ground connection, check
□ Cooling system, check or drain and flush (if COOL-GARD II is not used)	□ Engine speed, check and adjust
□ Crankcase vent system, clean or replace filter (optional)	□ Valve clearance, adjust
□ Thermostats, replace	□ Fuel injectors, replace

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

CD03523,00002A9 -19-03JAN11-1/1

Record Engine Serial Number (3029, 4045 and 6068 Engines)



RG8007 —UN—15JAN99

Engine Serial Number Plate

CD31240 —UN—24NOV10

3029, 4045 and 6068 Engine Serial Number Plate

A—Engine Serial Number Plate **B—Engine Serial Number** **C—Engine Model Number**

The engine serial number plate (A) is located on the right-hand side of engine block behind the fuel filter.

Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

Engine Serial Number (B)

_____

Engine Model Number (C)

_____

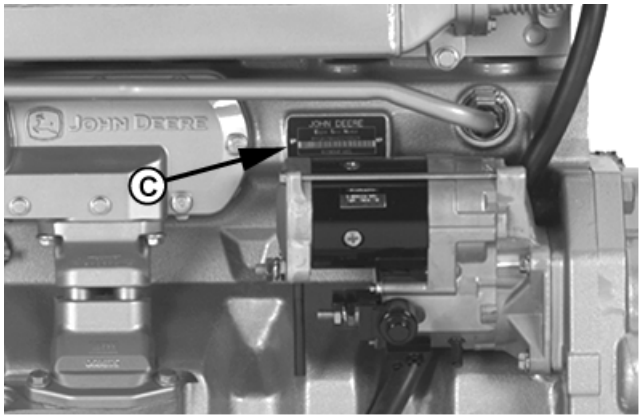
This information is very important for repair parts or warranty information.

CD03523,00002AA -19-23NOV10-1/1

Record Engine Serial Number (6090 Engines)

CD31241 —UN—24NOV10

6090 Engine Serial Number Plate



RG13813 —UN—11JAN05

Location of Engine Serial Number Plate

A—Engine Serial Number **B—Engine Model Number** **C—Engine Serial Number Plate**

The engine serial number plate (C) is located on the left-hand side of engine block between intake manifold and starter motor.

Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

Engine Serial Number (A

_____

Engine Model Number (B

_____

This information is very important for repair parts or warranty information.

CD03523,00002AB -19-23NOV10-1/1

Engine Option Codes

CD31242 —UN—24NOV10

A—Engine Base Code

In addition to the serial number plate, OEM engines have an engine option code label affixed to the rocker arm cover. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

An additional sticker may be also delivered (in a plastic bag attached to the engine or inserted in the machine documentation). It is recommended to stick this option code list sticker either:

- On this page of your Operator's manual below this section.
  or
- On the "Engine Owner's Warranty" booklet under the title Option Codes (Engine manufacturing configuration).

NOTE: The Machine Manufacturer may have already stuck it at a specific accessible place (inside the enclosure or close to a maintenance area).

The engine option code label includes an engine base code (A). This base code must also be recorded along with the option codes. At times it will be necessary to furnish this base code to differentiate two identical option codes for the same engine model.

The first two digits of each code identify a specific group, such as alternators. The last two digits of each code identify one specific option provided on your engine, such as a 12-volt, 55-amp alternator.

NOTE: These option codes are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

If an engine is ordered without a particular component, the last two digits of that functional group option code will be 99, 00, or XX. The list on the next page shows only the first two digits of the code numbers. For future reference such as ordering repair parts, it is important to have these code numbers available. To ensure this availability, enter the third and fourth digits shown on your engine option code label in the spaces provided on the following page.

NOTE: NOTE: Your engine option code label may not contain all option codes if an option has been added after the engine left the producing factory.

If option code label is lost or destroyed, consult your servicing dealer or engine distributor selling the engine for a replacement.

Option Codes	Description	Option Codes	Description
Engine Base Code:_____			
11____	Rocker Arm Cover	50____	Oil Pump
12____	Oil Filler Neck	51____	Cylinder Head With Valves
13____	Crankshaft Pulley	52____	Auxiliary Gear Drive
14____	Flywheel Housing	53____	Fuel Heater
15____	Flywheel	54____	Oil Heater
16____	Fuel Injection Pump	55____	Shipping Stand
17____	Air Inlet	56____	Paint Option
18____	Air Cleaner	57____	Coolant Inlet
19____	Oil Pan	59____	Oil Cooler
20____	Coolant Pump	60____	Add-on Auxiliary Drive Pulley
21____	Thermostat Cover	62____	Alternator Mounting

Continued on next page

Option Codes	Description	Option Codes	Description
22____	Thermostat	63____	Low Pressure Fuel Line
23____	Fan Drive	64____	Exhaust Elbow
24____	Fan Belt	65____	Turbocharger
25____	Fan	66____	Coolant Temperature Switch
26____	Engine Coolant Heater	67____	Electronic Tachometer Sensor
27____	Radiator	68____	Damper
28____	Exhaust Manifold	69____	Engine Serial Number Plate
29____	Ventilator System	72____	ECU Electronic Software Option
30____	Starting Motor	74____	Air Conditioner Compressor Mounting
31____	Alternator	75____	Air Restriction Indicator
32____	Instrument Panel	76____	Oil Pressure Switch
35____	Fuel Filter	81____	Primary Fuel Filter
36____	Front Plate	83____	Electronic Software
37____	Fuel Transfer Pump	84____	Electrical Wiring Harness
39____	Thermostat Housing	86____	Fan Pulley
40____	Oil Dipstick	87____	Belt Tensioner
41____	Belt Driven Front Auxiliary Drive	88____	Oil Filter
43____	Starting Aid	91____	Special Equipment (Factory Installed)
44____	Timing Gear Cover with Gears	93____	Emission Label
45____	Balancer Shaft	98____	Shipping
46____	Cylinder Block With Liners and Camshaft		
47____	Crankshaft and Bearings		
48____	Connecting Rods and Pistons		
49____	Valve Actuating Mechanisms		

CD03523,00002AC -19-03JAN11-2/2

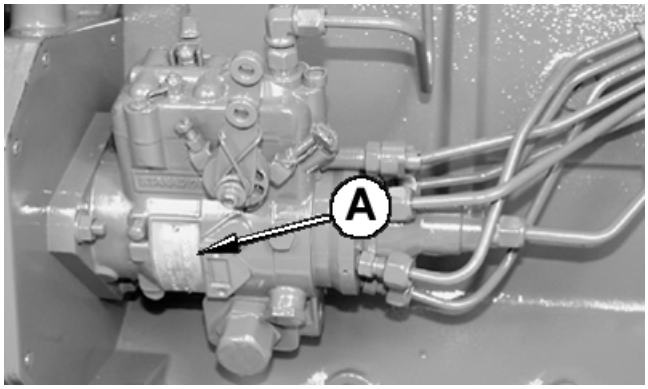
Record fuel injection pump model number

Record the fuel injection pump model and serial information found on the serial number plate (A).

Model No. _____ RPM _____

Manufacturer's No. _____

Serial No. _____



CD30749 —UN—24SEP99

DPSG,CD03523,15 -19-22JAN07-1/1

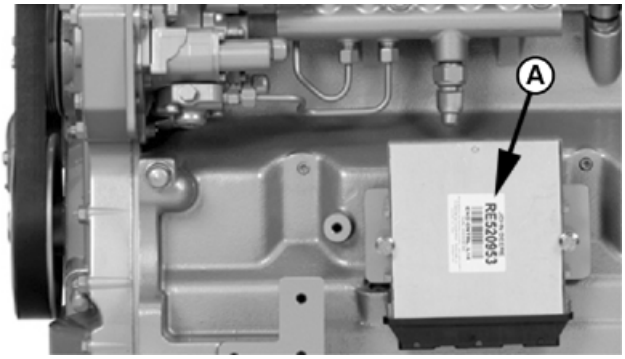
Record Engine Control Unit (ECU) Serial Number

Record the part number and serial number information found on the serial number label (A) on the Engine Control Unit (ECU) mounted on or near the engine.

Part No._____

Serial No._____

A—Serial Number Label



Record Engine Control Unit (ECU) Serial Number

CD03523,0000189 -19-06FEB07-1/1

Record High-Pressure Fuel Pump Model Number

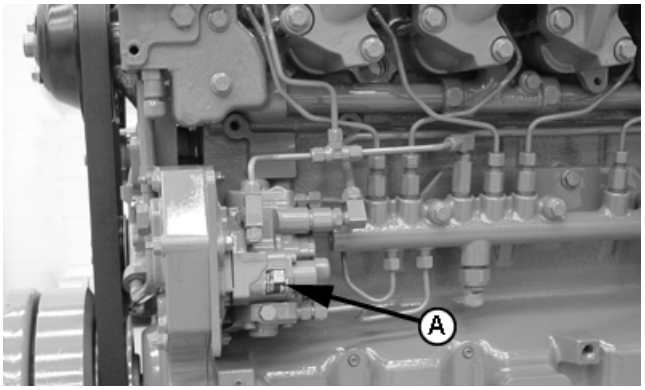
Record the high-pressure fuel pump model and serial number information found on the serial number plate (A).

Model No._____ RPM_____

Manufacturer's No._____

Serial No._____

A—Serial Number Plate



Record High-Pressure Fuel Pump Serial Number

CD03523,000018A -19-06FEB07-1/1

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.

T81389 —UN—07DEC88

DX,ALERT -19-29SEP98-1/1

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

TS187 —19—30SEP88

DX,SIGNAL -19-03MAR93-1/1

Do Not Open High-Pressure Fuel System

High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair of fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system.

Only technicians familiar with this type of system can perform repairs. (See your John Deere dealer.)

TS1343 —UN—18MAR92

DX,WW,HPCR1 -19-07JAN03-1/1

Engine lifting procedure

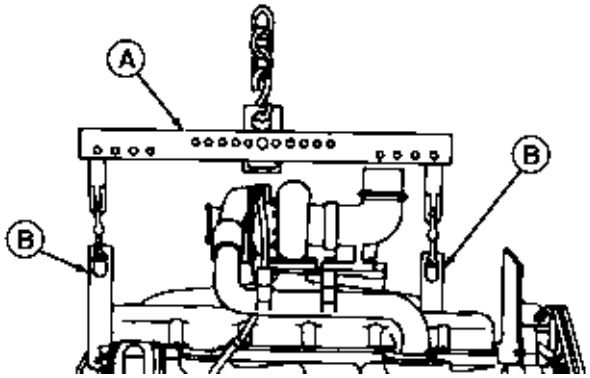
CAUTION: The only recommended method for lifting the engine is with JDG23 Engine Lifting Sling (A) and safety approved lifting straps (B) that come with engine. Use extreme caution when lifting and NEVER permit any part of the body to be positioned under an engine being lifted or suspended.

Lift engine with longitudinal loading on lifting sling and lifting straps only. Angular loading greatly reduces lifting capacity of sling and straps.

NOTE: If engine does not have lifting straps, universal straps can be procured through service parts under part numbers JD-244-1 and JD-244-2.

1. If not equipped, install lifting straps and torque to 200 N·m (145 lb-ft).
2. Attach JDG23 Engine Lifting Sling (A) to engine lifting straps (B) and overhead hoist.

IMPORTANT: Lifting straps are designed to lift the engine and accessories such as radiator, air filter and other small components. If larger components, such as power take-off, transmission, generator air compressor... etc, are attached to engine, the lifting straps provided with engine or through parts channel are not intended for this purpose. Technician is responsible for providing adequate lifting devices under these situations. See machine manuals for additional information on removing engine from machine.



RG7784 —UN—11NOV97

3. Carefully move engine to desired location.

DPSG,CD03523,95 -19-22JAN07-1/1

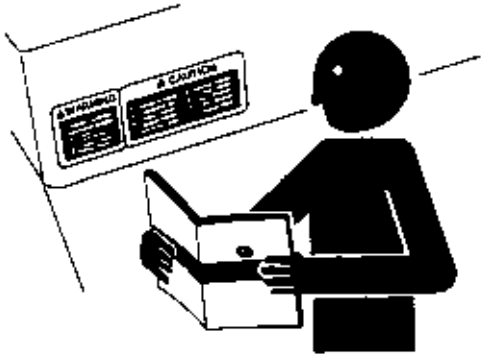
Follow Safety Instructions

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.



TS201 —UN—23AUG88

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.

DX,READ -19-16JUN09-1/1

Prevent Machine Runaway

Avoid possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.

TS177 —UN—11JAN89

DX,BYPAS1 -19-29SEP98-1/1

Handle Fuel Safely—Avoid Fires

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine. Fill fuel tank outdoors.

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.

TS202 —UN—23AUG88

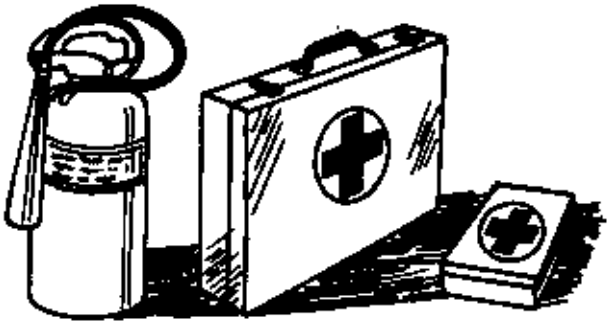
DX,FIRE1 -19-03MAR93-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 —UN—23AUG88

DX,FIRE2 -19-03MAR93-1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

Keep all sparks and flame away when using it. Keep starting fluid away from batteries and cables.

To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location.

Do not incinerate or puncture a starting fluid container.

TS1356 —UN—18MAR92

DX,FIRE3 -19-16APR92-1/1

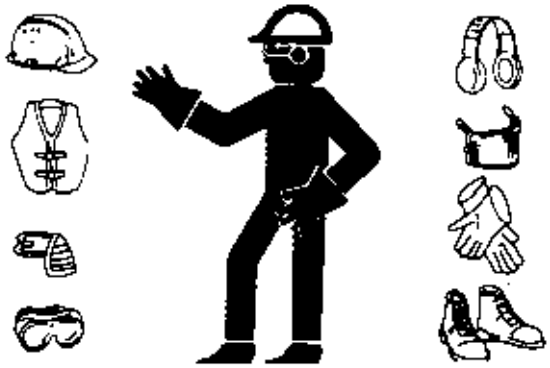
Wear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



TS206 —UN—23AUG88

DX,WEAR -19-10SEP90-1/1

Protect Against Noise

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

TS207 —UN—23AUG88

DX,NOISE -19-03MAR93-1/1

Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)

TS1132 —UN—26NOV90

DX,MSDS,NA -19-03MAR93-1/1

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close fitting clothing. Stop the engine and be sure the PTO driveline is stopped before making adjustments or performing any type service on the engine or PTO-driven equipment.

TS1644 —UN—22AUG95

CD,PTO -19-22JAN07-1/1

Practice Safe Maintenance

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.

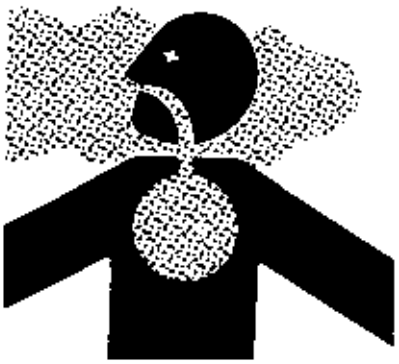
TS218 —UN—23AUG88

DX,SERV -19-17FEB99-1/1

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



TS220 —UN—23AUG88

DX,AIR -19-17FEB99-1/1

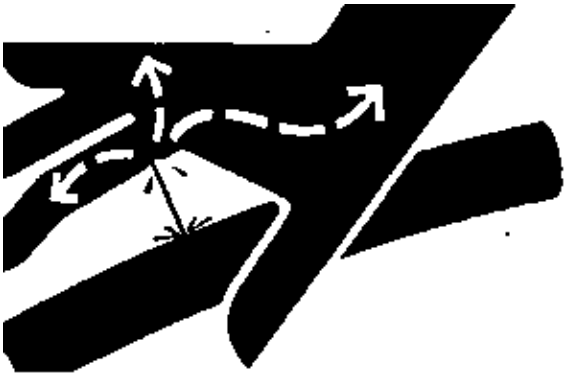
Avoid High-Pressure Fluids

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available in English from Deere & Company Medical Department in Moline, Illinois, U.S.A., by calling 1-800-822-8262 or +1 309-748-5636.



X9811 —UN—23AUG88

DX,FLUID -19-20AUG09-1/1

Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when heat goes beyond the immediate flame area.

TS953 —UN—15MAY90

DX,TORCH -19-10DEC04-1/1

Remove Paint Before Welding or Heating

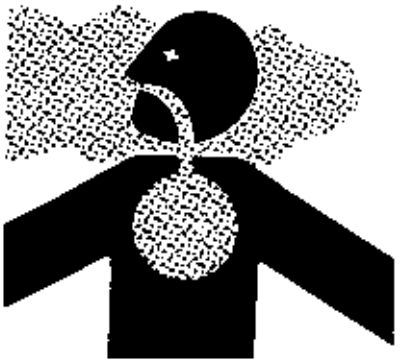
Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Do not use a chlorinated solvent in areas where welding will take place.



TS220 —UN—23AUG88

Do all work in an area that is well ventilated to carry toxic fumes and dust away.

Dispose of paint and solvent properly.

DX,PAINT -19-24JUL02-1/1

Service Cooling System Safely

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

TS281 —UN—23AUG88

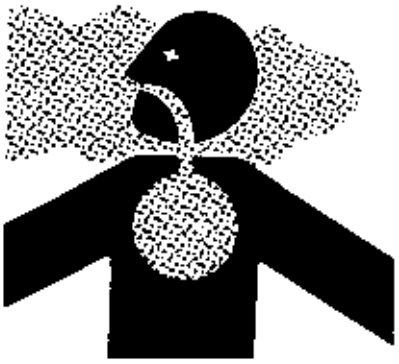
DX,RCAP -19-04JUN90-1/1

Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.



TS220 —UN—23AUG88

Keep bystanders away from the area.

DX,DUST -19-15MAR91-1/1

Dispose of Waste Properly

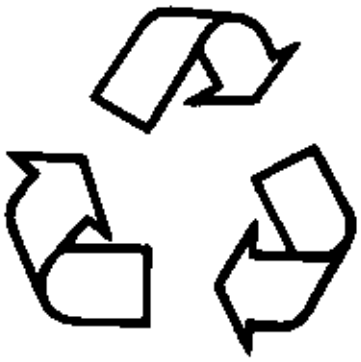
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



TS1133 —UN—26NOV90

DX,DRAIN -19-03MAR93-1/1

Diesel Fuel

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to EN 590 or ASTM D975 are recommended. Renewable diesel fuel produced by hydrotreating animal fats and vegetable oils is basically identical to petroleum diesel fuel. Renewable diesel that meets EN 590 or ASTM D975 is acceptable for use at all percentage mixture levels.

Required Fuel Properties

In all cases, the fuel shall meet the following properties:

Cetane number of 43 minimum. Cetane number greater than 47 is preferred, especially for temperatures below –20°C (–4°F) or elevations above 1500 m (5000 ft).

Cold Filter Plugging Point (CFPP) should be at least 5°C (9°F) below the expected lowest temperature or **Cloud Point** below the expected lowest ambient temperature.

Fuel lubricity should pass a maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156-1.

Sulfur Content for Interim Tier 4 and EU Stage IIIB Engines

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use ONLY ultra low sulfur diesel (ULSD) fuel with a maximum of 0.0015% (15 mg/kg) sulfur content.

Sulfur Content for Other Engines

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use of diesel fuel with sulfur content less than 0.10% (1000 mg/kg) is STRONGLY recommended.
- Use of diesel fuel with sulfur content 0.10% (1000 mg/kg) to 0.50% (5000 mg/kg) may result in REDUCED oil and filter change intervals. Refer to table in Diesel Engine Oil and Filter Service Intervals.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 mg/kg), contact your John Deere dealer.

IMPORTANT: Do not mix used diesel engine oil or any other type of lubricating oil with diesel fuel.

Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

DX,FUEL1 -19-03AUG09-1/1

Handling and Storing Diesel Fuel

CAUTION: Handle fuel carefully. Do not fill the fuel tank when engine is running.

DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.

Keep all storage tanks as full as practicable to minimize condensation.

Ensure that all fuel tank caps and covers are installed properly to prevent moisture from entering.

Monitor water content of the fuel regularly.

When using bio-diesel fuel, the fuel filter may require more frequent replacement due to premature plugging.

Check engine oil level daily prior to starting engine. A rising oil level may indicate fuel dilution of the engine oil.

IMPORTANT: The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier for recommendations.

DX,FUEL4 -19-19DEC03-1/1

Diesel Engine Break-In Oil

New engines are filled at the factory with either John Deere Break-In™ or Break-In™ Plus Engine Oil. During the break-in period, add John Deere Break-In™ or Break-In™ Plus Engine Oil, respectively, as needed to maintain the specified oil level.

Operate the engine under various conditions, particularly heavy loads with minimal idling, to help seat engine components properly.

Change the oil and filter at 100 hours maximum for Break-In™ Oil or 500 hours maximum for Break-In™ Plus Oil during the initial operation of a new or rebuilt engine.

After engine overhaul, fill the engine with either John Deere Break-In™ or Break-In™ Plus Engine Oil.

If John Deere Break-In™ or Break-In™ Plus Engine Oil is not available, use a 10W-30 diesel engine oil meeting one of the following during the first 100 hours of operation:

- API Service Classification CE
- API Service Classification CD
- API Service Classification CC
- ACEA Oil Sequence E2
- ACEA Oil Sequence E1

Break-In is a trademark of Deere & Company.
Plus-50 is a trademark of Deere & Company.

IMPORTANT: Do not use Plus-50™ II, Plus-50 or engine oils meeting any of the following for the initial break-in of a new or rebuilt engine:

API CJ-4	**ACEA E9**
API CI-4 PLUS	**ACEA E7**
API CI-4	**ACEA E6**
API CH-4	**ACEA E5**
API CG-4	**ACEA E4**
API CF-4	**ACEA E3**
API CF-2	
API CF	

These oils will not allow the engine to break in properly.

John Deere Break-In™ Plus Engine Oil can be used for all John Deere diesel engines at all emission certification levels.

After the break-in period, use John Deere Plus-50 ™ II, John Deere Plus-50, or other diesel engine oil as recommended in this manual.

DX,ENOIL4 -19-03AUG09-1/1

Engine Oil and Filter Service Intervals—Tier 3 and Stage III A Engines

Recommended oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of diesel fuel. Actual service intervals also depend on operation and maintenance practices.

Use oil analysis to evaluate the condition of the oil and to aid in selection of the proper oil and filter service interval. Contact your John Deere dealer for more information on engine oil analysis.

Change the oil and oil filter at least once every 12 months even if the hours of operation are fewer than the otherwise recommended service interval.

Diesel fuel sulfur content affects engine oil and filter service intervals.

- Use of diesel fuel with sulfur content less than 1000 mg/kg (1000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 1000—5000 mg/kg (1000—5000 ppm) REDUCES the oil and filter change interval.
- BEFORE using diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm), contact your John Deere dealer.
- DO NOT use diesel fuel with sulfur content greater than 10 000 mg/kg (10 000 ppm).

IMPORTANT: To avoid engine damage:

- **Reduce oil and filter service intervals by 50% when using biodiesel blends greater than B20. Oil analysis may allow longer service intervals.**
- **Use only approved oil types.**

Approved Oil Types:

- “Plus-50 Oils” include John Deere Plus-50™ II and John Deere Plus-50.
- “Other Oils” include John Deere Torq-Gard™, API CJ-4, API CI-4 PLUS, API CI-4, ACEA E9, ACEA E7, ACEA E6, ACEA E5, and ACEA E4.

NOTE: The 500 hour extended oil and filter change interval is only allowed if all of the following conditions are met:

- *Use of diesel fuel with sulfur content less than 5000 mg/kg (5000 ppm).*
- *Use of John Deere Plus-50™ II or Plus-50 Oil.*
- *Use of an approved John Deere oil filter.*

Engine Oil and Filter Service Intervals	
Fuel Sulfur	Less than 1000 mg/kg (1000 ppm)
Plus-50 Oils	500 hours
Other Oils	250 hours
Fuel Sulfur	1000—2000 mg/kg (1000—2000 ppm)
Plus-50 Oils	500 hours
Other Oils	250 hours
Fuel Sulfur	2000—5000 mg/kg (2000—5000 ppm)
Plus-50 Oils	500 hours
Other Oils	250 hours
Fuel Sulfur	5000—10 000 mg/kg (5000—10 000 ppm)
Plus-50 Oils	Contact John Deere dealer
Other Oils	Contact John Deere dealer
Oil analysis may extend the service interval of “Other Oils”, to a maximum not to exceed the interval of Plus-50 Oils.	

Plus-50 is a trademark of Deere & Company
Torq-Gard is a trademark of Deere & Company

DX,ENOIL13,T3,PTP,220toMAX -19-21JUN10-1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST -19-18MAR96-1/1

Mixing of Lubricants

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

DX,LUBMIX -19-18MAR96-1/1

Diesel Engine Coolant

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F).

John Deere COOL-GARD is preferred for service.

If John Deere COOL-GARD is not available, use a low silicate ethylene glycol or propylene glycol base coolant concentrate in a 50% mixture of concentrate with quality water.

The coolant concentrate shall be of a quality that provides cavitation protection to cast iron and aluminum parts in the cooling system. John Deere COOL-GARD meets this requirement.

Freeze protection

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F).

A 50% mixture of propylene glycol engine coolant in water provides freeze protection to -33°C (-27°F).

If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

Water quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

IMPORTANT: Do not mix ethylene glycol and propylene glycol base coolants.

DX,COOL8 -19-16NOV01-1/1

Operating in Warm Temperature Climates

John Deere engines are designed to operate using glycol base engine coolants.

Always use a recommended glycol base engine coolant, even when operating in geographical areas where freeze protection is not required.

John Deere COOL-GARD™ II Premix is available in a concentration of 50% ethylene glycol. However, there are situations in warm temperature climates where a coolant with lower glycol concentration (approximately 20% ethylene glycol) has been approved. In these cases, the low glycol formulation has been modified to provide the same level of corrosion inhibitor as John Deere COOL-GARD II Premix (50/50).

COOL-GARD is a trademark of Deere & Company

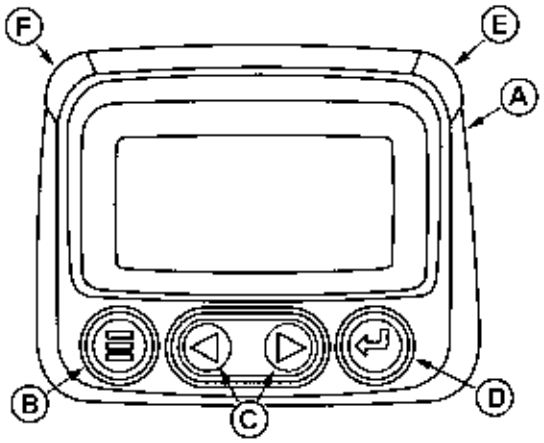
IMPORTANT: Water may be used as coolant *in emergency situations only.*

Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation will occur when water is used as the coolant, even when coolant conditioners are added.

Drain cooling system and refill with recommended glycol base engine coolant as soon as possible.

DX,COOL6 -19-03NOV08-1/1

Using Diagnostic Gauge to Access Engine Information (Optional equipment)



RG13132 —UN—09SEP03

Diagnostic Gauge

A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Enter Key
E—Red "STOP ENGINE" Indicator Light
F—Amber "WARNING" Indicator Light

NOTE: Generator sets powered by an electronically controlled engine (DE10 or HPCR fuel system) can be optionally equipped with the diagnostic gauge shown. Depending on the generator set manufacturer, other instrumentations can be used. Refer to the generator set documentation for more information.

The diagnostic gauge (A) allows the operator to view many readouts of engine functions and trouble codes (DTCs). The gauge is linked to the electronic control system and its sensors. This allows the operator to monitor engine functions and to troubleshoot the engine systems when needed.

Press the menu key (B) to access the various engine functions in sequence. The displays can be selected as either customary English or metric units. The following menu of engine parameters can be displayed on the diagnostic gauge window:

- Engine hours
- Engine rpm
- System voltage
- Percent engine load at the current rpm
- Coolant temperature
- Oil pressure
- Throttle position
- Intake manifold temperature
- Current fuel consumption
- Active service (diagnostic) codes
- Stored service (diagnostic) codes from the engine
- Set the units for display
- View the engine configuration parameters

NOTE: Engine parameters which can be accessed will vary with the engine application. Six languages for readouts are available and can be selected during setup of gauge.

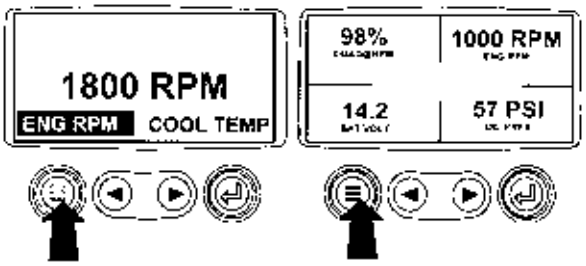
The diagnostic gauge includes a graphical backlit Liquid Crystal Display (LCD) screen. The display can show either a single parameter or a quadrant display showing four parameters simultaneously. The diagnostic gauge uses two arrow keys (C) for scrolling through the engine parameter list and viewing the menu list and an enter key (D) for selecting highlighted items. The red (E) and amber (F) lights are used to signal active trouble code received by the diagnostic gauge.

CD03523,000018B -19-22JAN07-1/1

Main Menu Navigation

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



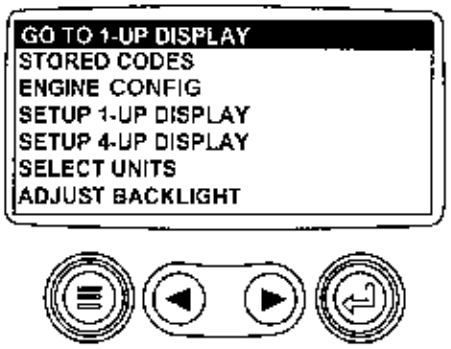
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000A9 -19-03SEP03-1/5

2. The first seven items of the "Main Menu" will be displayed.

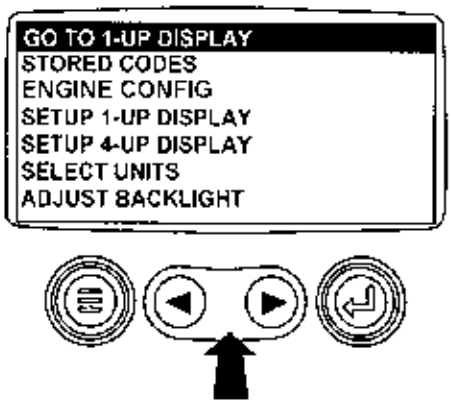


RG13160 —UN—02OCT03

Menu Display

OURGP11,00000A9 -19-03SEP03-2/5

3. Pressing the "Arrow" keys will scroll through the menu selections.

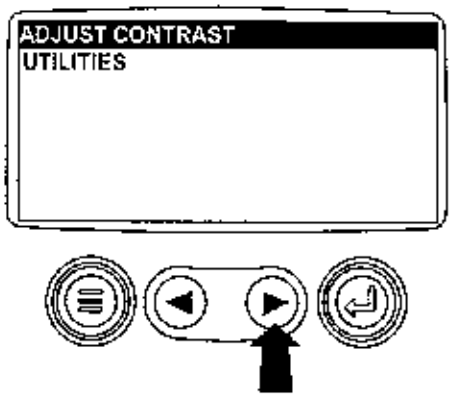


RG13161 —UN—02OCT03

Main Menu Items

OURGP11,00000A9 -19-03SEP03-3/5

4. Pressing the right arrow key will scroll down to reveal the last items of "Main Menu" screen, highlighting the next item down.



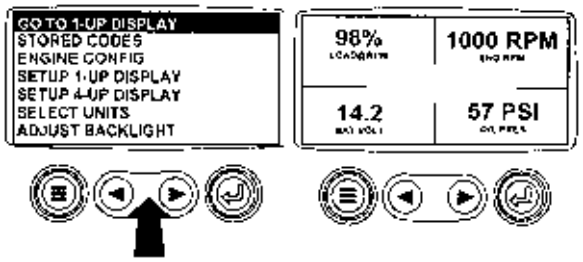
RG13162 —UN—26SEP03

Last Items On Main Menu

Continued on next page

OURGP11,00000A9 -19-03SEP03-4/5

5. Use the arrow keys to scroll to the desired menu item or press the "Menu Button" to exit the main menu and return to the engine parameter display.



RG13163 —UN—02OCT03

Use Arrow Buttons To Scroll / Quadrant Display

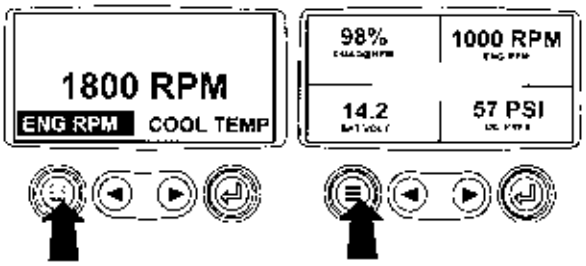
OURGP11,00000A9 -19-03SEP03-5/5

Engine Configuration Data

NOTE: The engine configuration data is a read only function.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

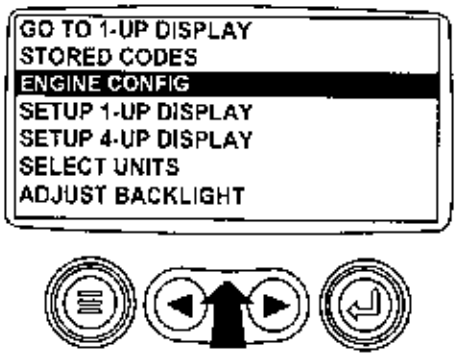


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000AB -19-03SEP03-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Engine Config" is highlighted.



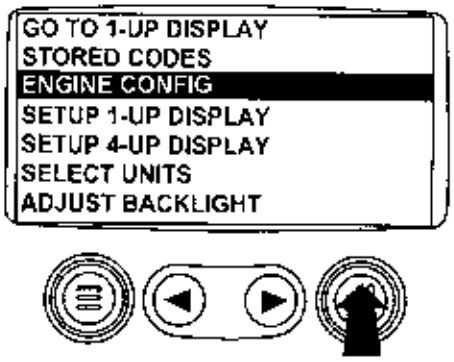
RG13164 —UN—07OCT03

Select Engine Configuration

Continued on next page

OURGP11,00000AB -19-03SEP03-2/6

3. Once "Engine Config" menu item has been highlighted, press the "Enter" key to view the engine configuration data.

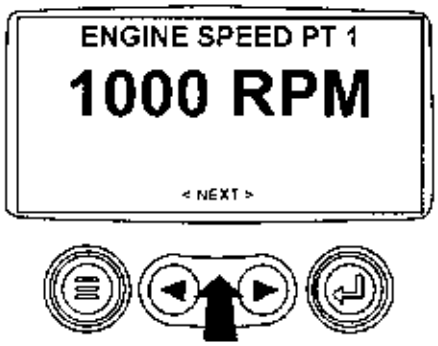


RG13165 —UN—02OCT03

Enter Key

OURGP11,00000AB -19-03SEP03-3/6

4. Use the "Arrow" keys to scroll through the engine configuration data.

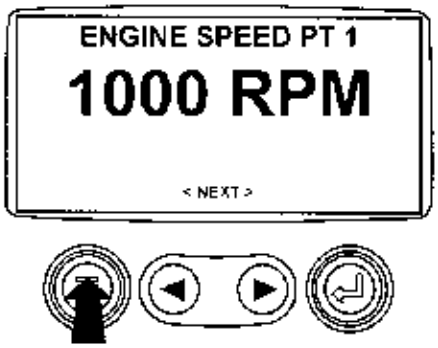


RG13166 —UN—29SEP03

Use Arrow Keys To Scroll

OURGP11,00000AB -19-03SEP03-4/6

5. Press the "Menu" key to return to the main menu.



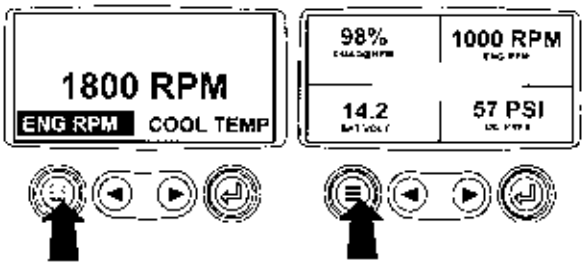
RG13167 —UN—29SEP03

Return To Main Menu

Continued on next page

OURGP11,00000AB -19-03SEP03-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



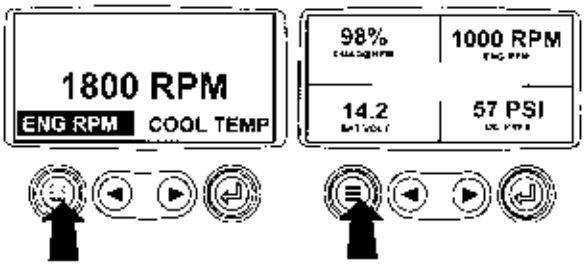
Exit Main Menu

OURGP11,00000AB -19-03SEP03-6/6

Accessing Stored Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.

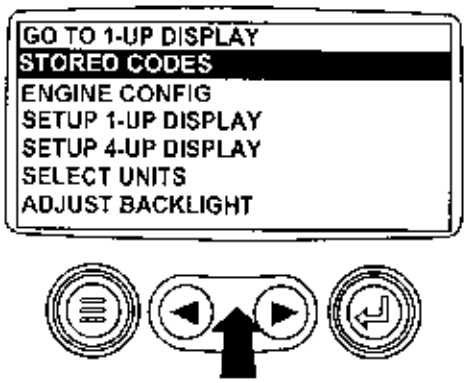


Menu Key

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

OURGP11,00000AC -19-03SEP03-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Stored Codes" is highlighted.

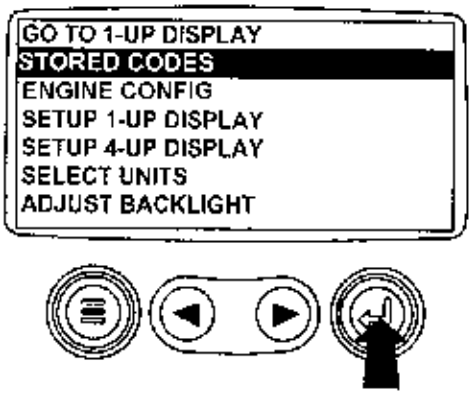


Select Stored Codes

Continued on next page

OURGP11,00000AC -19-03SEP03-2/6

3. Once the "Stored Codes" menu item has been highlighted press the "Enter" key to view the stored codes.

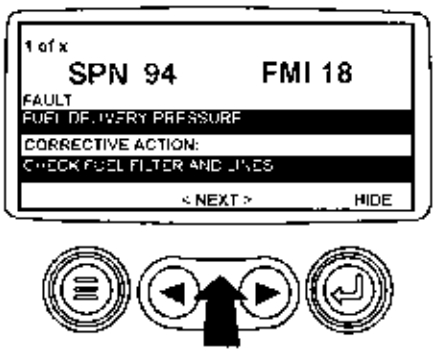


RG13169 —UN—02OCT03

Enter Key

OURGP11,00000AC -19-03SEP03-3/6

4. If the word "Next" appears above the "Arrow" keys, there are more stored codes that may be viewed. Use the "Arrow" key to scroll to the next stored code.

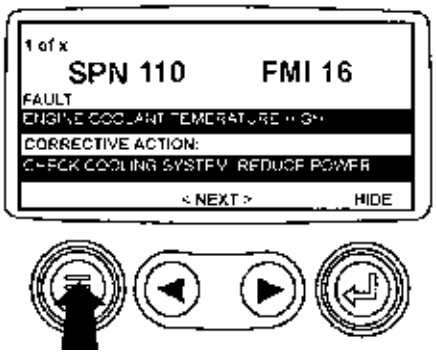


RG13245 —UN—02OCT03

Use Arrow Keys To Scroll

OURGP11,00000AC -19-03SEP03-4/6

5. Press the "Menu" key to return to the main menu.



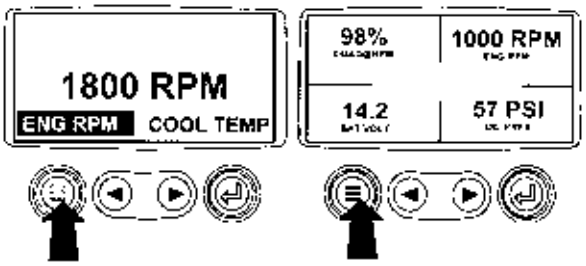
RG13246 —UN—02OCT03

Return To Main Menu

Continued on next page

OURGP11,00000AC -19-03SEP03-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



RG13159 —UN—26SEP03

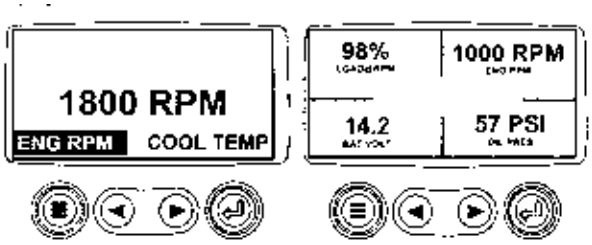
Exit Main Menu

OURGP11,00000AC -19-03SEP03-6/6

Accessing Active Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.



RG13172 —UN—26SEP03

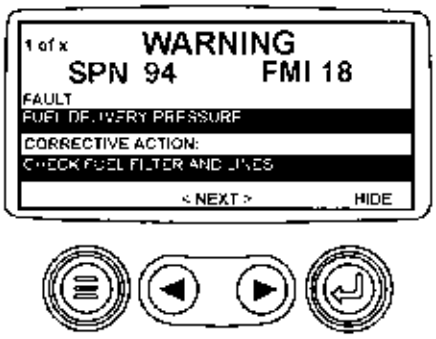
Normal Operation

1. During normal operation the single or four parameter screen will be displayed.

OURGP11,00000AD -19-03SEP03-1/7

2. When the diagnostic gauge receives a trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Warning" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

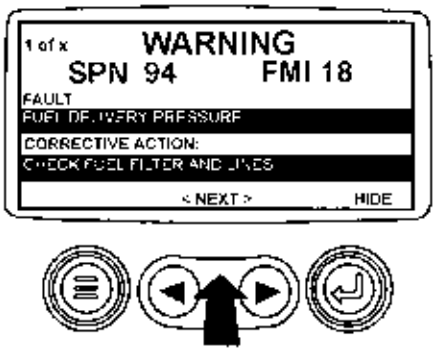


RG13240 —UN—30SEP03

Active Trouble Codes Displayed

OURGP11,00000AD -19-03SEP03-2/7

3. If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.



RG13241 —UN—30SEP03

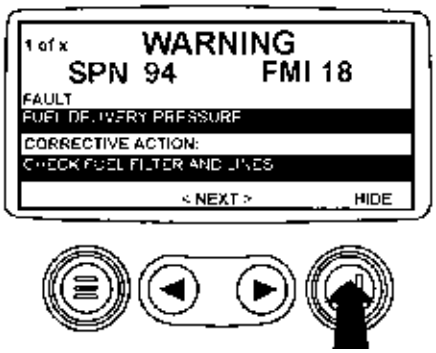
Use Arrow Keys To Scroll

Continued on next page

OURGP11,00000AD -19-03SEP03-3/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

4. To acknowledge and hide the code and return to the single or four parameter display, press the "Enter" Key.

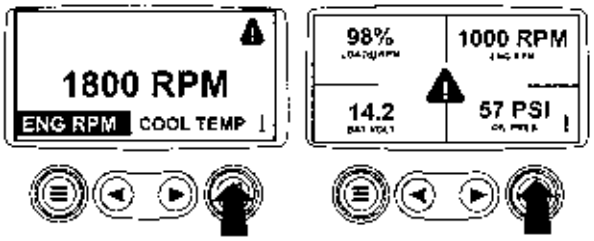


RG13242 —UN—30SEP03

Hide Trouble Codes

OURGP11,00000AD -19-03SEP03-4/7

5. The display will return to the single or four parameter display, but the display will contain the warning icon. Pressing the "Enter" key will redisplay the hidden trouble code.



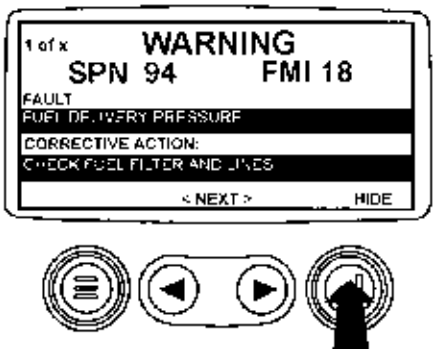
RG13176 —UN—26SEP03

Active Trouble Code Icon

OURGP11,00000AD -19-03SEP03-5/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

6. Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.

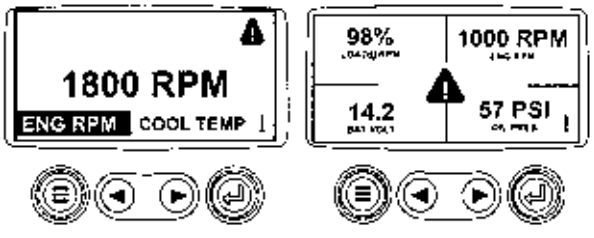


RG13242 —UN—30SEP03

Enter Key

OURGP11,00000AD -19-03SEP03-6/7

7. The single or four parameter screen will display the warning icon until the trouble code condition is corrected.



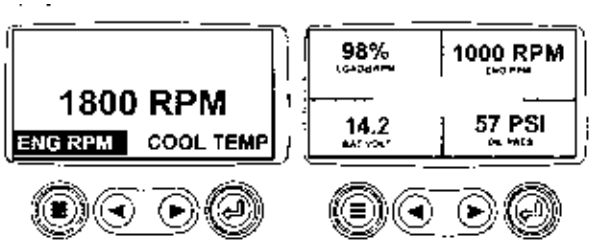
RG13243 —UN—01OCT03

Active Trouble Code Condition

OURGP11,00000AD -19-03SEP03-7/7

Engine Shutdown Codes

1. During normal operation the single or four parameter screen will be displayed.



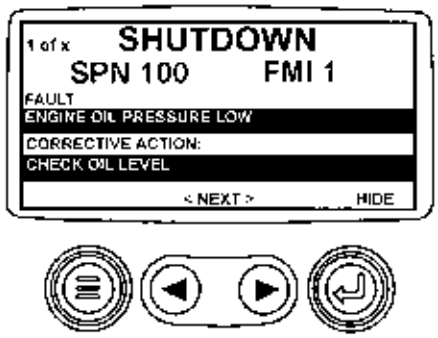
RG13172 —UN—26SEP03

Normal Operation

OURGP11,00000AE -19-03SEP03-1/6

2. When the diagnostic gauge receives a severe trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Shutdown" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

   If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.



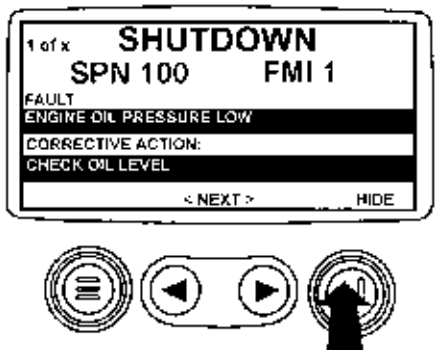
RG13238 —UN—29SEP03

Shutdown Message

OURGP11,00000AE -19-03SEP03-2/6

3. To acknowledge and hide the trouble code and return to the single or four parameter display, press the "Enter" key".

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



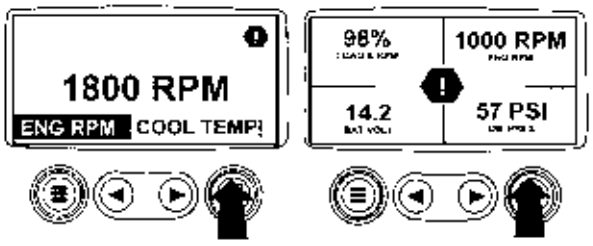
RG13239 —UN—29SEP03

Hide Trouble Code

OURGP11,00000AE -19-03SEP03-3/6

4. The display will return to the single or four parameter display, but the display will contain the "Shutdown" icon. Pressing the "Enter" key will redisplay the hidden trouble code.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



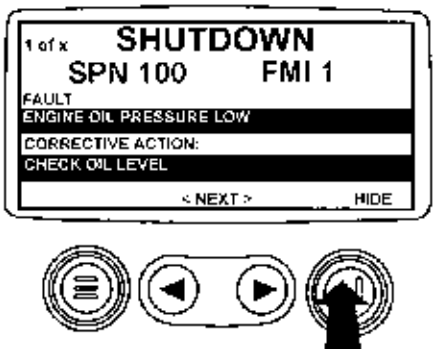
RG13179 —UN—26SEP03

Flashing Shutdown Icon

Continued on next page

OURGP11,00000AE -19-03SEP03-4/6

5. Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.



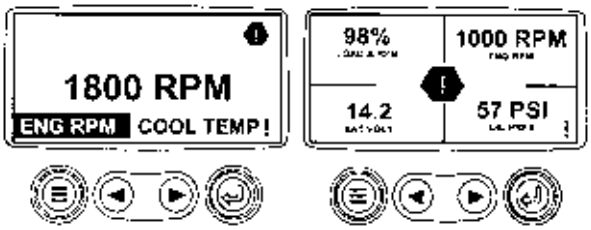
RG13239 —UN—29SEP03

Redisplay Trouble Code

OURGP11,00000AE -19-03SEP03-5/6

6. The single or four parameter screen will display the shutdown icon until the trouble code condition is corrected.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



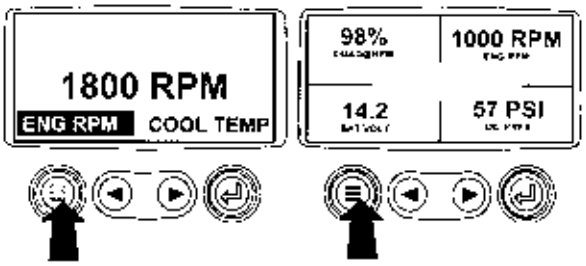
RG13180 —UN—26SEP03

Shutdown Icon

OURGP11,00000AE -19-03SEP03-6/6

Adjusting Backlighting

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

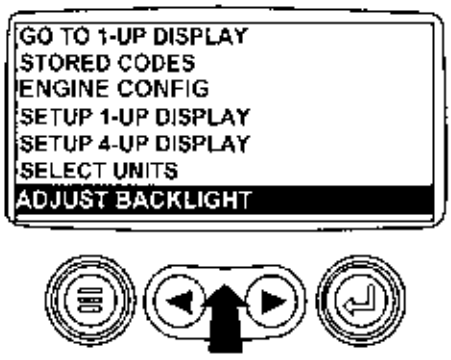


RG13159 —UN—26SEP03

Menu Key

OURGP11,0000237 -19-21OCT03-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Backlight" is highlighted.



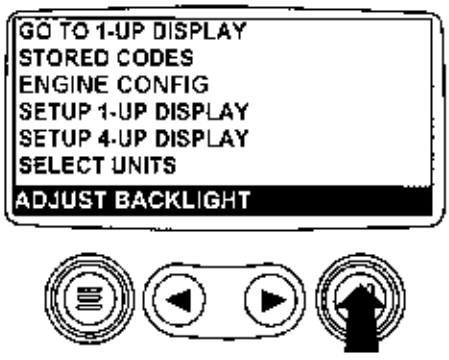
RG13181 —UN—02OCT03

Select Adjust Backlight

Continued on next page

OURGP11,0000237 -19-21OCT03-2/6

3. Once the "Adjust Backlight" menu item has been highlighted, press the "Enter" key to activate the "Adjust Backlight" function.

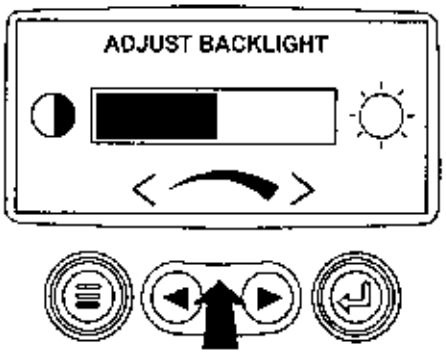


RG13182 —UN—02OCT03

Press Enter Key

OURGP11,0000237 -19-21OCT03-3/6

4. Use the "Arrow" keys to select the desired backlight intensity.

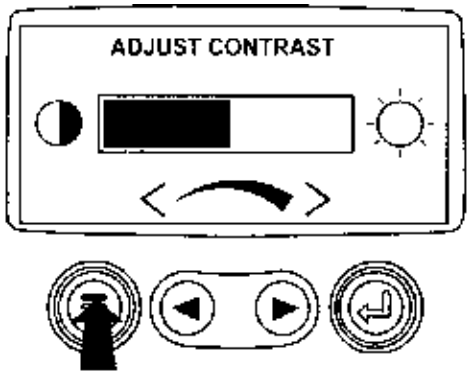


RG13183 —UN—29SEP03

Adjust Backlight Intensity

OURGP11,0000237 -19-21OCT03-4/6

5. Press the "Menu" key to return to the main menu.



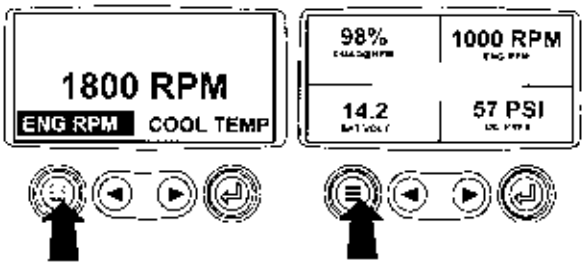
RG13184 —UN—26SEP03

Return To Main Menu

Continued on next page

OURGP11,0000237 -19-21OCT03-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.

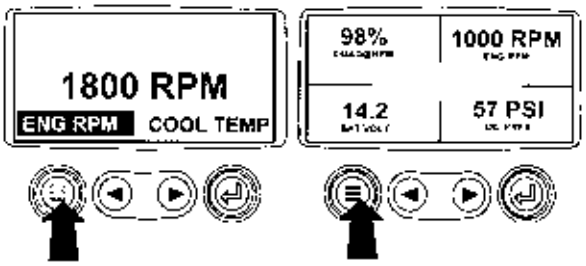


Exit Main Menu

OURGP11,0000237 -19-21OCT03-6/6

Adjusting Contrast

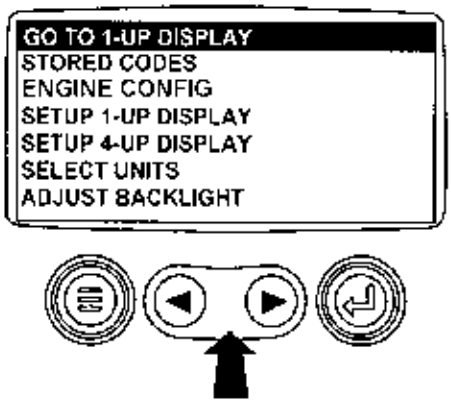
1. Turn the key switch to the ON position. Starting at the single or four engine parameter display press the "Menu" key.



Menu Key

OURGP11,00000AF -19-03SEP03-1/6

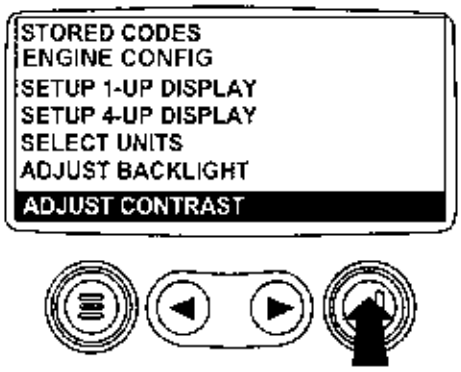
2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Contrast" is highlighted.



Select Adjust Contrast

OURGP11,00000AF -19-03SEP03-2/6

3. Once the "Adjust Contrast" menu item has been highlighted, press the "Enter" key to activate the "Adjust Contrast" function.

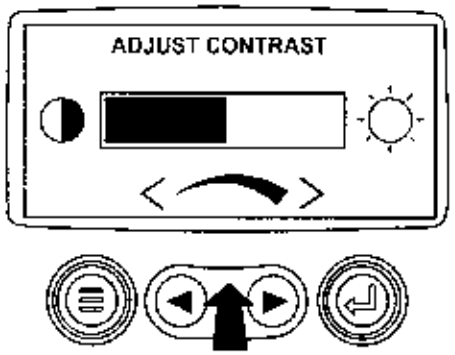


Press Enter Key

Continued on next page

OURGP11,00000AF -19-03SEP03-3/6

4. Use the "Arrow" keys to select the desired contrast intensity.

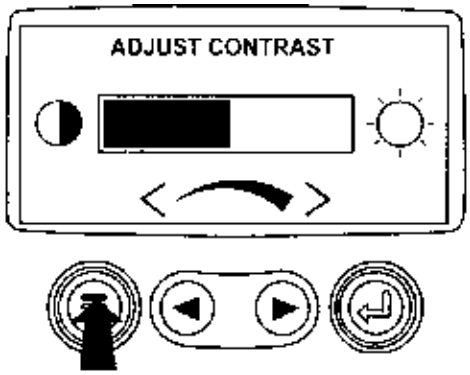


RG13186 —UN—29SEP03

Adjust Contrast Intensity

OURGP11,00000AF -19-03SEP03-4/6

5. Press the "Menu" key to return to the main menu.

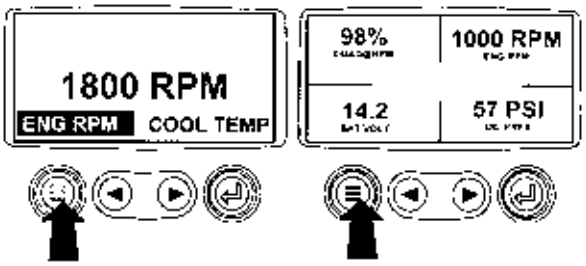


RG13187 —UN—26SEP03

Return To Main Menu

OURGP11,00000AF -19-03SEP03-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



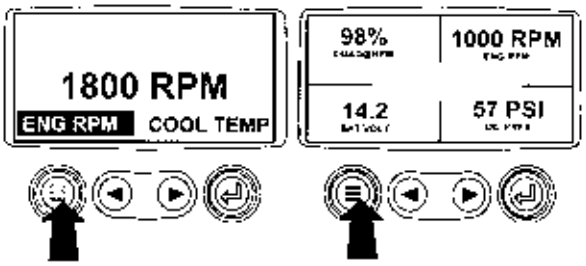
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,00000AF -19-03SEP03-6/6

Selecting Units Of Measurement

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



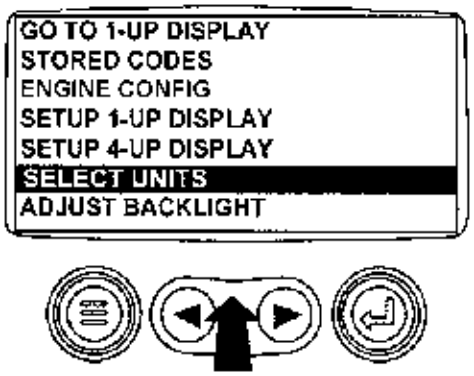
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000B0 -19-03SEP03-1/7

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Select Units" is highlighted.

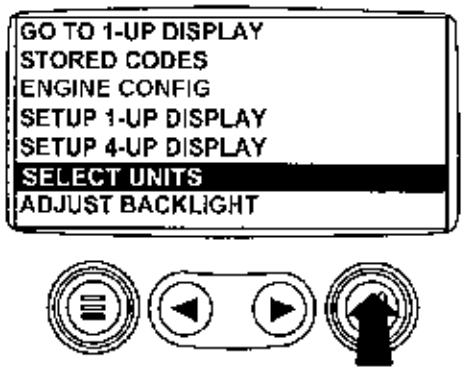


RG13188 —UN—02OCT03

Select Units

OURGP11,00000B0 -19-03SEP03-2/7

3. Once the "Select Units" menu item has been highlighted press the "Enter" key to access the "Select Units" function.



RG13189 —UN—02OCT03

Press Enter Key

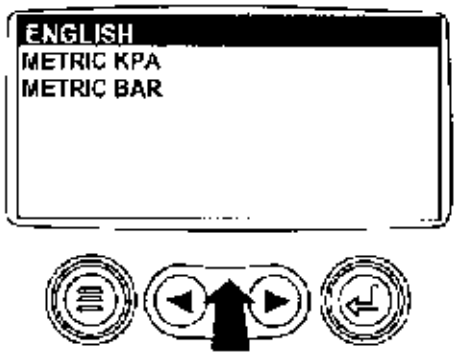
OURGP11,00000B0 -19-03SEP03-3/7

4. There are three choices for units of measurement, English, Metric kPa or Metric Bar.

   English is for Imperial units, with pressures displayed in PSI and temperatures in °F.

   Metric kPa and Metric bar are for IS units, with pressures displayed in kPa and bar respectively, and temperatures in °C.

   Use the "Arrow" keys to highlight the desired units of measurement.



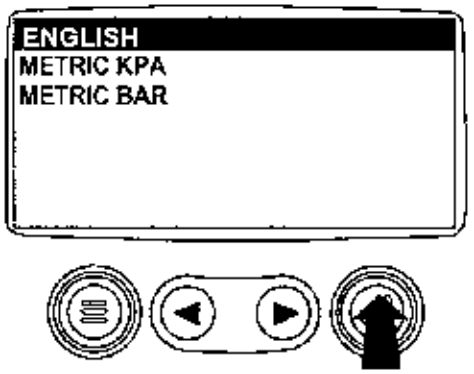
RG13190 —UN—26SEP03

Select Desired Units

Continued on next page

OURGP11,00000B0 -19-03SEP03-4/7

5. Press the "Enter" key to select the highlighted units.

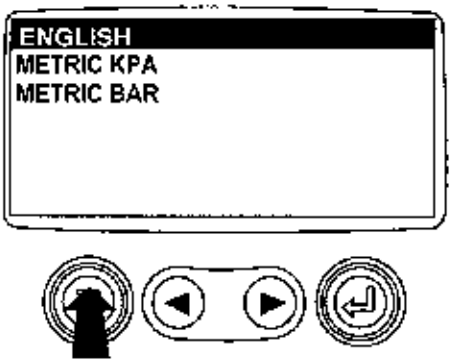


RG13191 —UN—30SEP03

Press Enter Key to Select

OURGP11,00000B0 -19-03SEP03-5/7

6. Press the "Menu" key to return to the main menu.

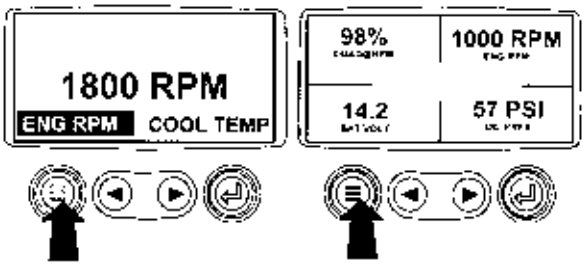


RG13192 —UN—26SEP03

Return To Main Menu

OURGP11,00000B0 -19-03SEP03-6/7

7. Press the "Menu" key to return to the engine parameter display.



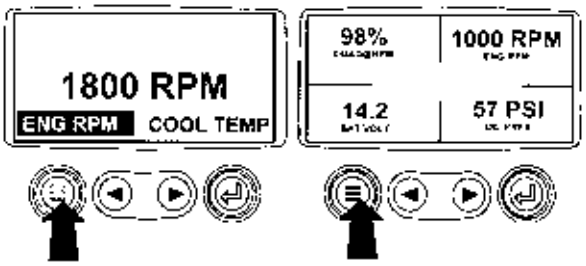
RG13159 —UN—26SEP03

Press Menu Key

OURGP11,00000B0 -19-03SEP03-7/7

Setup 1-Up Display

1. Turn the key switch to the ON position. Starting at the single engine parameter display, press the "Menu" key.



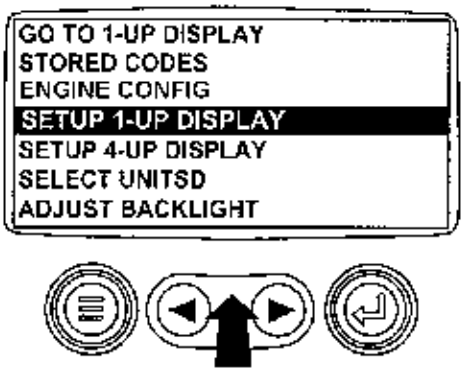
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000B1 -19-03SEP03-1/18

2. Use the "Arrow" keys to scroll through the menu until "Setup 1-Up Display" is highlighted.

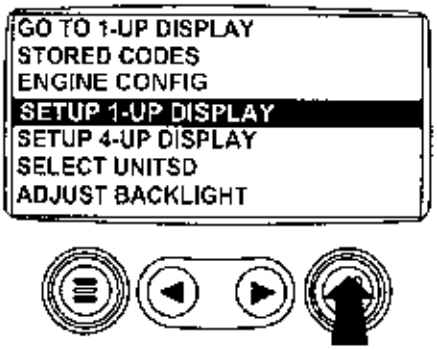


RG13193 —UN—02OCT03

Setup 1-Up Display

OURGP11,00000B1 -19-03SEP03-2/18

3. Once "Setup 1-Up Display" menu item has been highlighted press the "Enter" key to access the "Setup 1-Up Display" function.

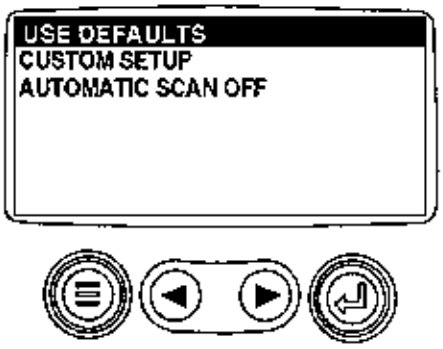


RG13194 —UN—02OCT03

Press Enter Key

OURGP11,00000B1 -19-03SEP03-3/18

4. Three options are available for modification of the 1-Up Display.
   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Hours, Engine Speed, Battery Voltage, % Load, Coolant Temperature and Oil Pressure.
   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters. This option can be used to add parameters available for scrolling in the 1-Up Display.
   c. **Automatic Scan** – Selecting the scan function will allow the 1-Up Display to scroll through the selected set of parameters one at a time, momentarily pausing at each.



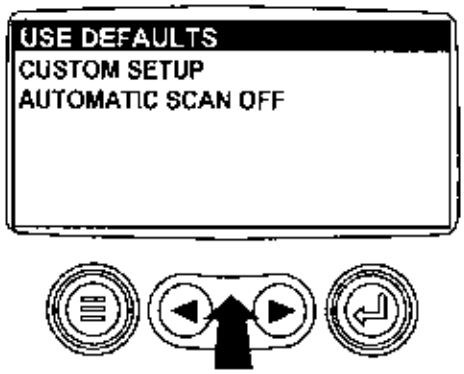
RG13196 —UN—26SEP03

1-Up Display Options

Continued on next page

OURGP11,00000B1 -19-03SEP03-4/18

5. **Use Defaults** - To select "Use Defaults" use the Arrow keys to scroll to and highlight "Use Defaults" in the menu display.

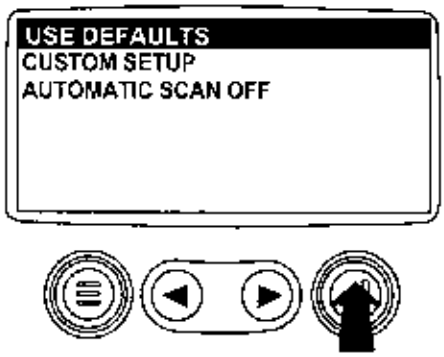


RG13195 —UN—26SEP03

Select Defaults

OURGP11,00000B1 -19-03SEP03-5/18

6. Press the "Enter" key to activate the "Use Defaults" function.

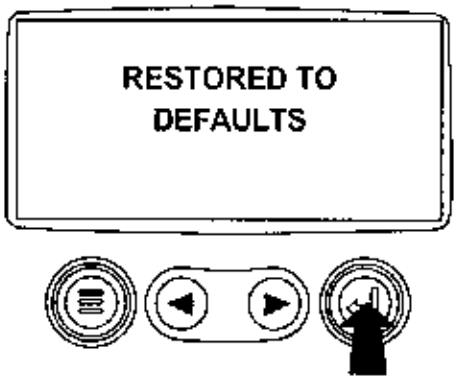


RG13197 —UN—29SEP03

Defaults Selected

OURGP11,00000B1 -19-03SEP03-6/18

7. The display parameters are reset to the factory defaults, then the display will return to the "Setup 1-Up Display" menu.



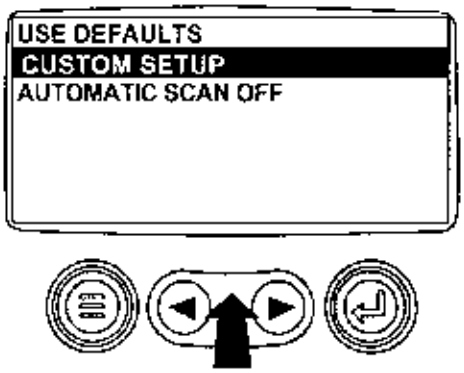
RG13149 —UN—24SEP03

Restored To Defaults

Continued on next page

OURGP11,00000B1 -19-03SEP03-7/18

8. **Custom Setup** - To perform a custom setup of the 1-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

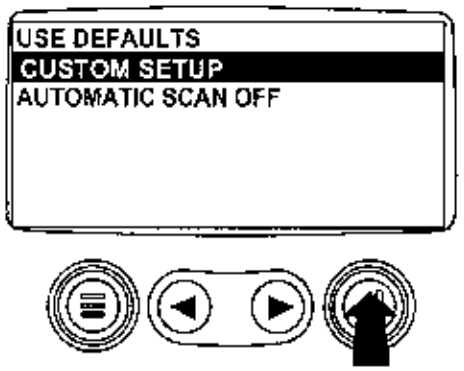


RG13198 —UN—26SEP03

Select Custom Setup

OURGP11,00000B1 -19-03SEP03-8/18

9. Press the "Enter" key to display a list of engine parameters.

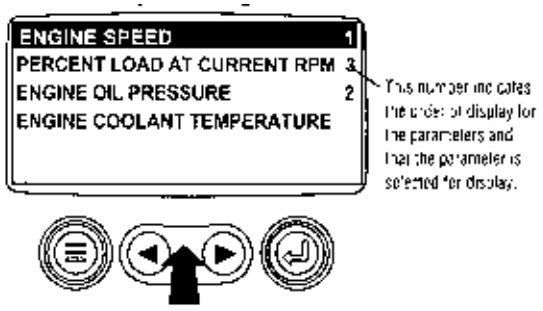


RG13199 —UN—26SEP03

Engine Parameters

OURGP11,00000B1 -19-03SEP03-9/18

10. Use the "Arrow" keys to scroll to and highlight a selected parameter (parameter with a number to right of it).



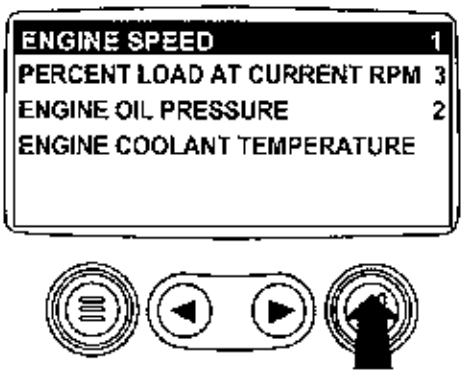
RG13150 —UN—24SEP03

Select Parameters

Continued on next page

OURGP11,00000B1 -19-03SEP03-10/18

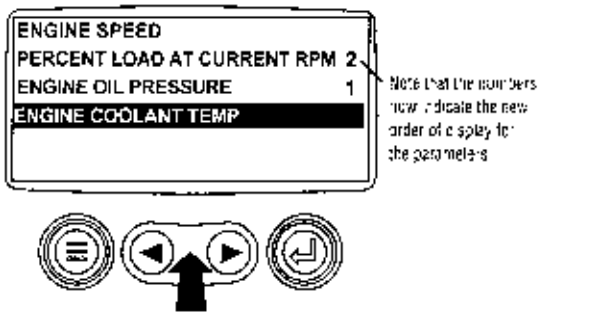
11. Press the "Enter" key to deselect the selected parameter, removing it from the list of parameters being displayed on the 1-Up Display.



Deselect Parameters

OURGP11,00000B1 -19-03SEP03-11/18

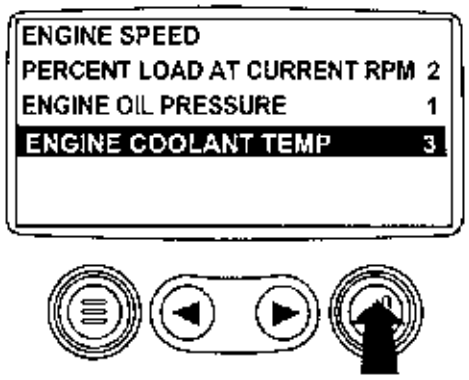
12. Use the "Arrow" keys to scroll and highlight the desired parameter that has not been selected for display (parameter without a number to right of it).



Select Desired Parameters

OURGP11,00000B1 -19-03SEP03-12/18

13. Press the "Enter" key to select the parameter for inclusion in the Single Engine Parameter Display.
14. Continue to scroll through and select additional parameters for the custom 1-Up Display. Press the "Menu" key at any time to return to the "Custom Setup" menu.

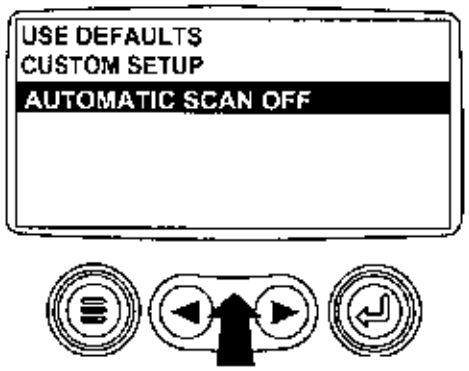


Select Parameters For Display

Continued on next page

OURGP11,00000B1 -19-03SEP03-13/18

15. **Automatic Scan** - Selecting the scan function will allow the 1- Up Display to scroll through the selected set of parameters one at a time. Use the "Arrow" keys to scroll to the "Automatic Scan" function.

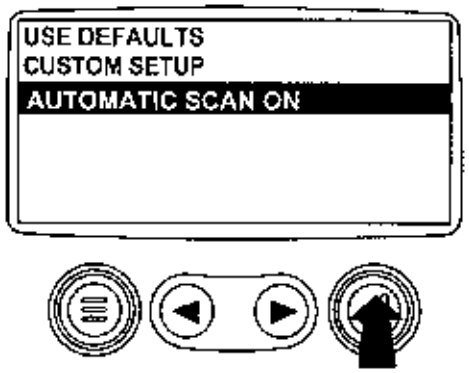


RG13221 —UN—26SEP03

Automatic Scan Off

OURGP11,00000B1 -19-03SEP03-14/18

16. Press the "Enter" key to toggle the "Automatic Scan" function on.

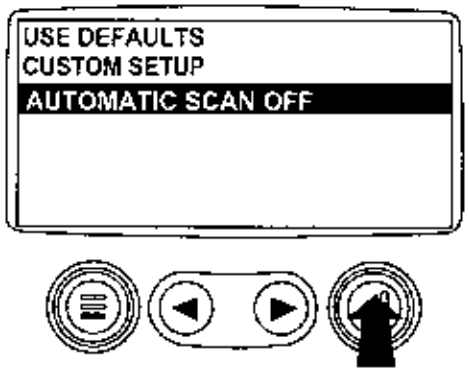


RG13222 —UN—26SEP03

Automatic Scan On

OURGP11,00000B1 -19-03SEP03-15/18

17. Press the "Enter" key again to toggle the "Automatic Scan" function off.



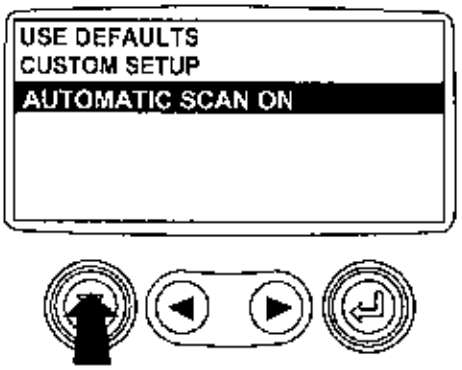
RG13223 —UN—26SEP03

Automatic Scan Off

Continued on next page

OURGP11,00000B1 -19-03SEP03-16/18

18. Once the "Use Defaults", "Custom Setup" and "Automatic Scan" functions have been set, press the "Menu" key to return to the main menu.

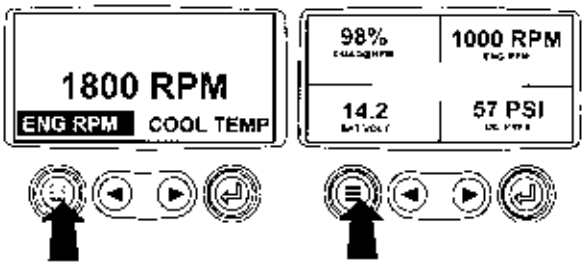


RG13224 —UN—26SEP03

Menu Key

OURGP11,00000B1 -19-03SEP03-17/18

19. Press the "Menu" key to exit the main menu and return to the engine parameter display.



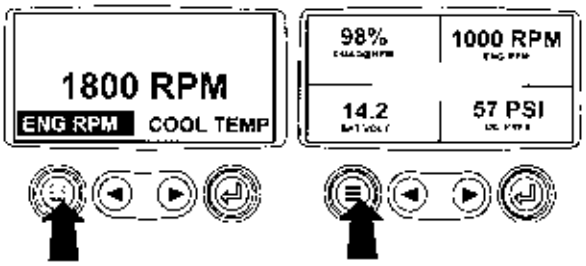
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,00000B1 -19-03SEP03-18/18

Setup 4-Up Display

1. Turn the key switch to the ON position. From the single or four engine parameter display, press the "Menu" key.

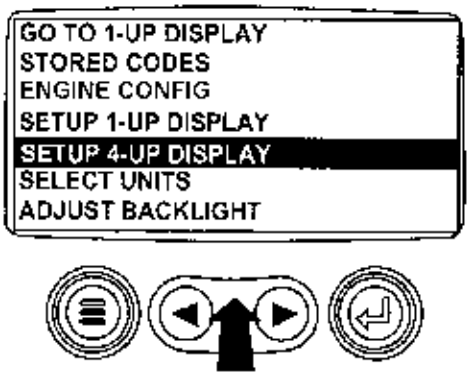


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000B2 -19-03SEP03-1/14

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Setup 4-Up Display" is highlighted.



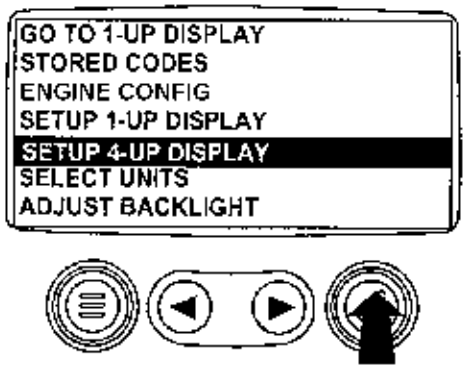
RG13225 —UN—02OCT03

Select Setup 4-Up Display

Continued on next page

OURGP11,00000B2 -19-03SEP03-2/14

3. Once the "Setup 4-Up Display" menu item has been highlighted, press the "Enter" key to activate the "Setup 4-Up Display" menu.

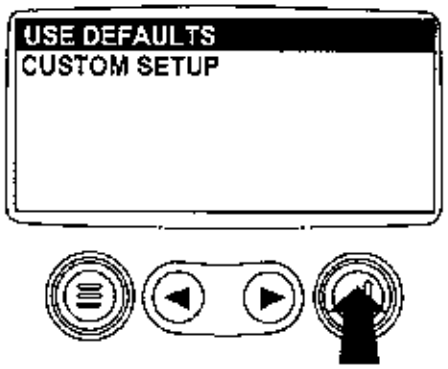


RG13226 —UN—02OCT03

Press Enter Key

OURGP11,00000B2 -19-03SEP03-3/14

4. Two options are available for the 4-Up Display.
   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Speed, Battery Voltage, Coolant Temperature and Oil Pressure.
   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters.

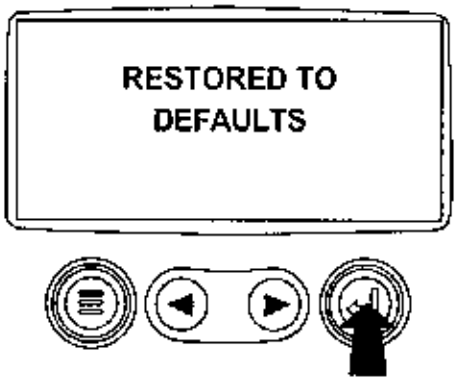


RG13244 —UN—02OCT03

Select Factory Defaults

OURGP11,00000B2 -19-03SEP03-4/14

5. To reset the display parameters to the factory defaults, scroll to and highlight "Use Defaults". Press the "Enter" key to activate the "Use Defaults" function. A message indicating the display parameters are reset to the factory defaults will be displayed, then the display will return to the "Setup 4-Up Display" menu.



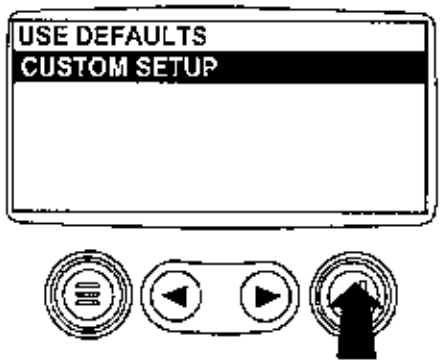
RG13149 —UN—24SEP03

Restored To Defaults

Continued on next page

OURGP11,00000B2 -19-03SEP03-5/14

6. **Custom Setup** - To perform a custom setup of the 4-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

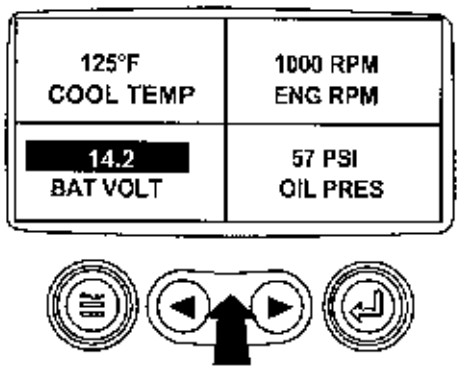


RG13227 —UN—26SEP03

Custom Setup

OURGP11,00000B2 -19-03SEP03-6/14

7. The quadrant with the highlighted parameter value is the current selected parameter. Use the "Arrow" keys to highlight the value in the quadrant you wish to change to a new parameter.

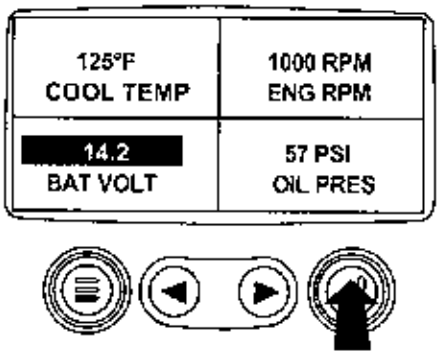


RG13228 —UN—26SEP03

Select Parameters

OURGP11,00000B2 -19-03SEP03-7/14

8. Press the "Enter" key and a list of engine parameters will be displayed.



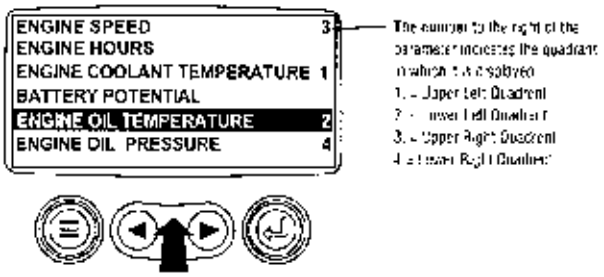
RG13229 —UN—26SEP03

List Of Engine Parameters

Continued on next page

OURGP11,00000B2 -19-03SEP03-8/14

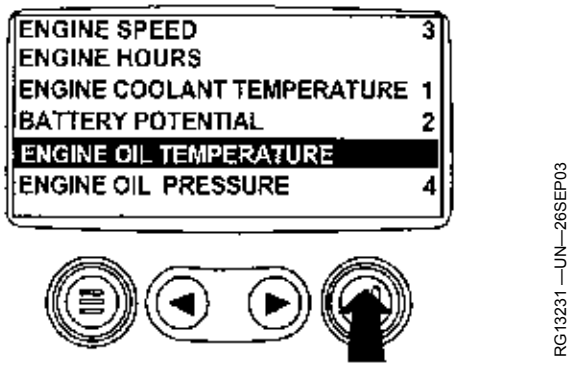
9. The parameter that is highlighted is the selected parameter for the screen. Use the "arrow" keys to highlight the new parameter to be placed in the "4-Up Display".



Select Desired Engine Parameter

OURGP11,00000B2 -19-03SEP03-9/14

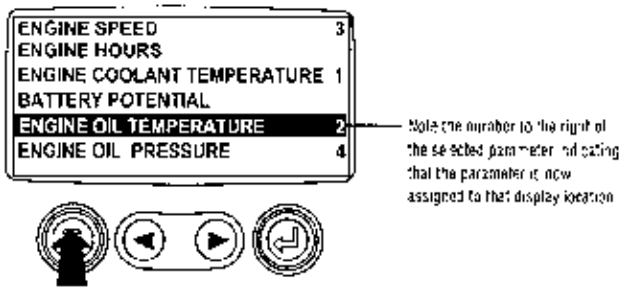
10. Press the "Enter" key to change the selected parameter in the quadrant to the new parameter.



Enter Selected Parameter

OURGP11,00000B2 -19-03SEP03-10/14

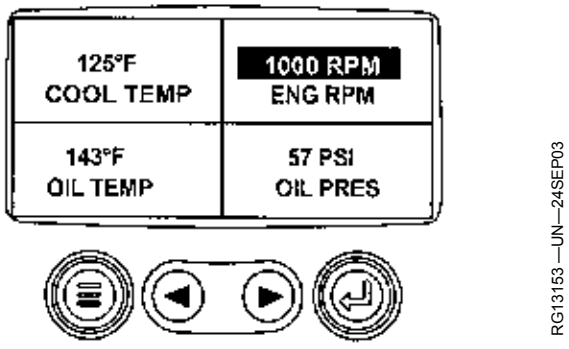
11. Use the "Menu" keys to return to the "4-Up Custom Setup" screen.



Return To 4-Up Custom Setup

OURGP11,00000B2 -19-03SEP03-11/14

12. The selected quadrant has now changed to the new selected parameter.

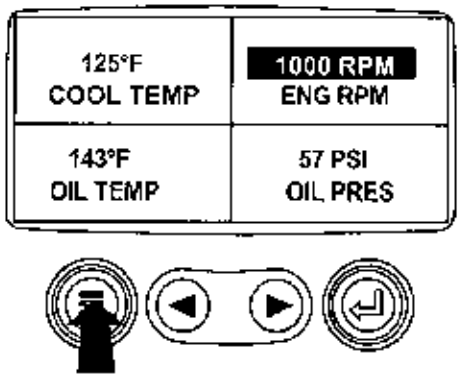


4-Up Display

Continued on next page

OURGP11,00000B2 -19-03SEP03-12/14

13. Repeat the parameter selection process until all spaces are as desired.
14. Press the "Menu" key to return to the main menu.

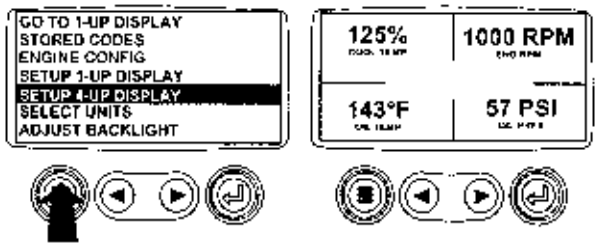


RG13154 —UN—24SEP03

Return To Main Menu

OURGP11,00000B2 -19-03SEP03-13/14

15. Press the "Menu" key to exit the main menu and return to the engine parameter display.



RG13155 —UN—07OCT03

Select Remaining Parameters

OURGP11,00000B2 -19-03SEP03-14/14

Break-in period

Within first 100 hours of operation:
During the first 100 hours of operation, avoid overloading, excessive idling and no-load operation.

If oil has to be added during this time, see ENGINE BREAK-IN OIL.

NOTE: During the break-in period a higher-than-usual oil consumption should be considered as normal.

After first 100 hours of operation:

After the first 100 hours, drain the crankcase and change the oil filter (see CHANGING ENGINE OIL AND FILTER). Fill crankcase with seasonal viscosity grade oil (see DIESEL ENGINE OIL).

Check tension of alternator belt.

Check connections of air intake hoses.

Check for proper tightening of cap screws all around the engine.

DPSG,CD03523,17 -19-22JAN07-1/1

Starting the engine

CAUTION: Before starting engine in a confined building, install proper outlet exhaust ventilation equipment. Always use safety approved fuel storage and piping.

NOTE: If temperature is below 0 ° C (32 ° F), it may be necessary to use cold weather starting aids (See COLD WEATHER OPERATION).

1. Perform all prestarting checks outlined in Maintenance/Daily Section.
2. Open the fuel supply shut-off valve, if equipped.
3. Activate the starter motor switch to crank the engine and release it as soon as engine starts.

NOTE: Do not operate the starter motor more than 20 seconds at a time.

DPSG,CD03523,18 -19-22JAN07-1/1

Cold Weather Operation

Depending on equipment, various cold weather starting aids are available to assist in starting the engine at temperature below 0° C (32 °F).

Air intake heater

⚠ CAUTION: DO NOT use starting fluid on engines equipped with grid-type air intake heater or glow plug (s). Ether starting fluid is highly flammable and may explode, causing serious injury.

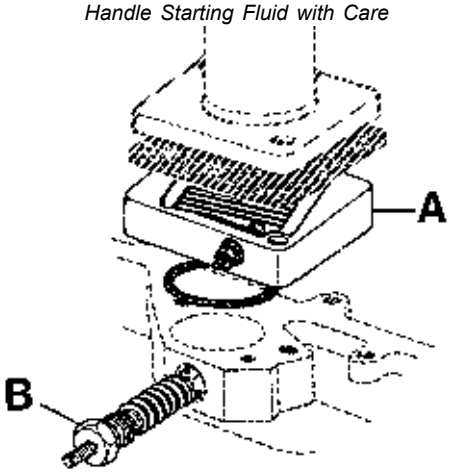
NOTE: On engines with electronically controlled fuel system, the air intake heater operates automatically, controlled by the ECU. An engine preheater indicator light comes on when the key switch is turned ON. In warm weather, the light comes on briefly for a light check. In cold weather, the light remains ON during the automatic operation of the air intake heater or glow plug (s). Operating time depends on temperature. Do not crank engine until light goes OFF.

- **3029 engines** are optionally equipped with the single glow plug (B) screwed in cylinder head intake manifold. Activate the glow plug (preheater position) for 30 seconds maximum then start the engine.
- **4045, 6068 and 6090 engines** are optionally equipped with the grid-type air heater (A).
  Turn key switch ON, but DO NOT crank engine until engine preheater indicator light turns OFF.

A—Grid-Type Air Heater (4045, 6068 and 6090 Engines) **B—Single Glow Plug (3029 Engines)**

Handle Starting Fluid with Care

TS1356 —UN—18MAR92



Glow Plug or Grid-Type Air Heater

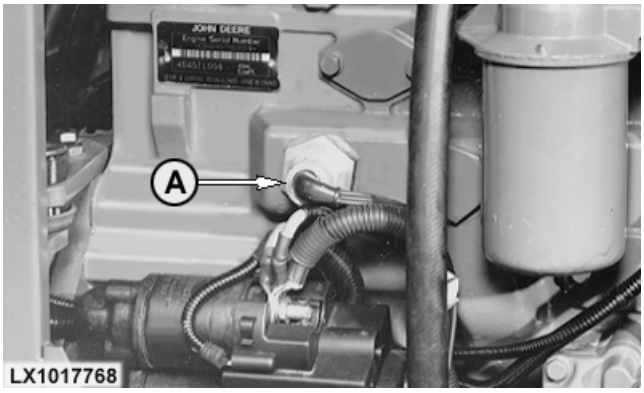
CD30750 —UN—03SEP99

CD03523,00002AD -19-25NOV10-1/3

Coolant heater

Connect plug of coolant heater (A) to a proper power source (110 or 220 V).

At an ambient temperature of -15 °C (5 °F), the heating process takes approximately 2 hours. Extend heating period if ambient temperature is lower.



Coolant Heater

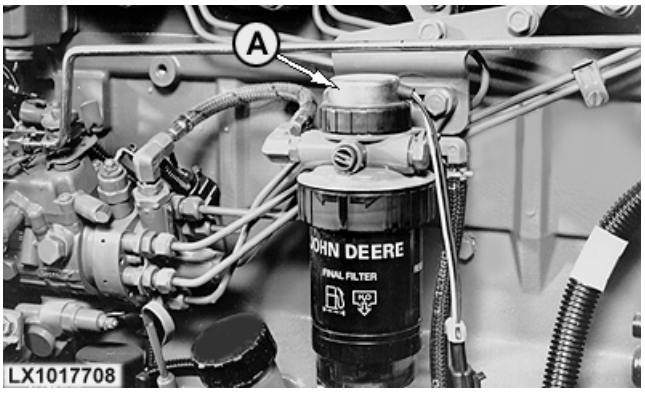
LX1017768 —UN—24OCT97

Continued on next page

CD03523,00002AD -19-25NOV10-2/3

Fuel preheater

Fuel preheater (A) switches ON and OFF automatically in relation with the ambient temperature.



Fuel Preheater

CD03523,00002AD -19-25NOV10-3/3

Using a booster battery or charger

A 12-volt booster battery can be connected in parallel with battery(ies) on the unit to aid in cold weather starting. ALWAYS use heavy duty jumper cables.

CAUTION: Gas given off by battery is explosive. Keep sparks and flames away from battery. Before connecting or disconnecting a battery charger, turn charger off. Make last connection and first disconnection at a point away from battery. Always connect NEGATIVE (–) cable last and disconnect this cable first.

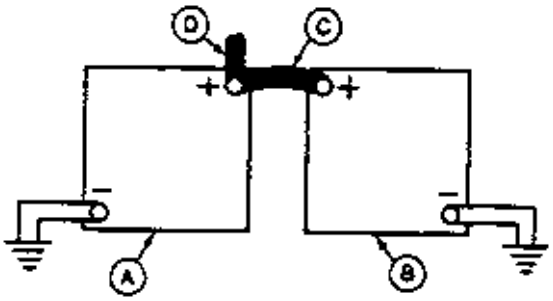
IMPORTANT: Be sure polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12-volt booster battery for 12-volt electrical systems and 24-volt booster battery(ies) for 24-volt electrical systems.

1. Connect booster battery or batteries to produce the required system voltage for your engine application.

NOTE: To avoid sparks, DO NOT allow the free ends of jumper cables to touch the engine.

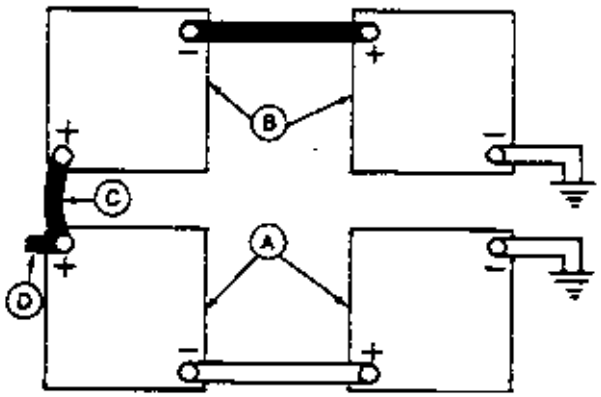
2. Connect one end of jumper cable to the POSITIVE (+) post of the booster battery.
3. Connect the other end of the jumper cable to the POSITIVE (+) post of battery connected to starter.
4. Connect one end of the other jumper cable to the NEGATIVE (–) post of the booster battery.
5. ALWAYS complete the hookup by making the last connection of the NEGATIVE (–) cable to a good ground on the engine frame and away from the battery(ies).
6. Start the engine. Disconnect jumper cables immediately after engine starts. Disconnect NEGATIVE (–) cable first.

TS204 —UN—23AUG88



RG4678 —UN—14DEC88

12-Volt System



RG4698 —UN—14DEC88

24-Volts System

A—12-Volt Machine battery (ies)
B—12-Volt Booster battery (ies)
C—Booster cable
D—Cable to starter motor

DPSG,CD03523,20 -19-22JAN07-1/1

Engine operation

Warming engine
Operate engine at high idle for 1 to 2 minutes before applying the load.

NOTE: This procedure does not apply to standby generator sets where the engine is loaded immediately upon reaching rated speed.

Normal engine operation
Compare engine coolant temperature and engine oil pressure with specifications below:

	Specification
Minimum oil pressure at full load rated speed[1] —Pressure	275 kPa (2.75 bar) (40 psi)
Coolant temperature range—Temperature	82°—94°C (180°—202°F)

Stop engine immediately if coolant temperature is above or oil pressure below specifications or if there are any signs of part failure. Symptoms that may be early signs of engine problems could be:

- Sudden loss of power
- Unusual noise or vibration
- Excessive black exhaust
- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

[1]*Oil at normal operating temperature of 115°C (240°F).*

Recommendation for turbocharger engines
Should the engine stall when operating under load, IMMEDIATELY restart it to prevent overheating of turbocharger components.

Idling engine
Avoid excessive engine idling. Prolonged idling may cause the engine coolant temperature to fall below its normal range. This, in turn, causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge and unburned fuel in the exhaust system. If an engine will be idling for more than 5 minutes, stop and restart later.

NOTE: Generator set applications have the governor locked at a specified speed and do not have a slow idle function. These engines idle at no load governed speed (fast idle).

DPSG,CD03523,21 -19-22JAN07-1/1

Standby power units

To assure that your engine will deliver efficient standby operation when needed, start engine and run at rated speed (with 50%—70% load) for 30 minutes every 2 weeks. DO NOT allow engine to run extended period of time with no load.

DPSG,CD03523,22 -19-22JAN07-1/1

Stopping the engine

1. Before stopping, run engine for at least 2 minutes at fast idle and no load.
2. Stop the engine.

DPSG,CD03523,23 -19-22JAN07-1/1

Changing Generator Frequency

All generator sets are dual-frequency; 50 Hz (1500 rpm) or 60 Hz (1800 rpm). Refer to the generator set documentation for more information.

CD03523,00002AE -19-25NOV10-1/1

Observe service intervals

Using hour meter as a guide, perform all services at the hourly intervals indicated on following pages. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed using charts provided in Maintenance Records Section.

IMPORTANT: Recommended service intervals are for normal operating conditions. Service MORE OFTEN if engine is operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.

DPSG,CD03523,24 -19-22JAN07-1/1

Use correct fuels, lubricants and coolant

IMPORTANT: Use only fuels, lubricants, and coolants meeting specifications outlined in Fuels, Lubricants, and Coolant Section when servicing your John Deere Engine.

Consult your John Deere engine distributor, servicing dealer or your nearest John Deere Parts Network for recommended fuels, lubricants, and coolant. Also available are necessary additives for use when operating engines in tropical, arctic, or any other adverse conditions.

TS100 —UN—23AUG88

DPSG,CD03523,25 -19-22JAN07-1/1

Maintenance Interval Chart

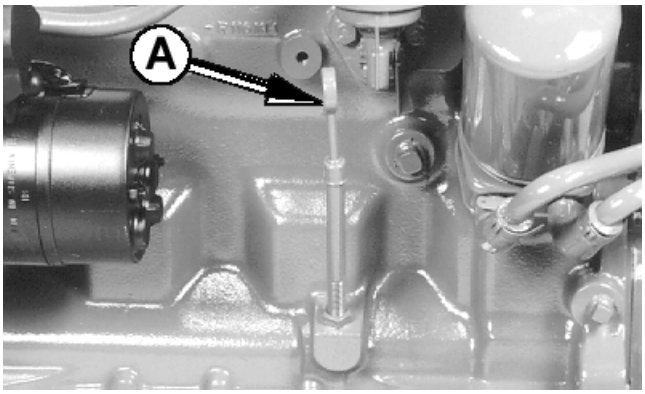
Item	10 H / Daily	Every 2 Weeks	500 H	1000 H / 1 Year	2000 H / 2 Years	3000 H / 3 Years	4500 H	As Required
Check engine oil and coolant level	•							
Check air filter restriction indicator[a]	•							
Check fuel filter/Water bowl	•							
Operate engine at rated speed and 50—70% load a minimum of 30 minutes [b]		•						
Change engine oil and filter[c]			•					
Replace fuel filter element(s)			•					
Check crankcase vent system			•					
Check engine mounts			•					
Check engine ground connection			•					
Check belt tension and automatic tensioner				•				
Check cooling system				•				
Check air intake system				•				
Replace crankcase vent filter (optional)				•				
Check crankshaft vibration damper (6 cyl.)[d]				•				
Check and adjust engine speed				•				
Drain and flush cooling system[e]					•	•		
Adjust valve clearance					•			
Replace crankshaft vibration damper (6 cyl.)							•	
Bleed the fuel system								•
Clean or replace air filter element (see note a)								•
Replace fan/alternator belt								•
Test thermostat and injection nozzles (see your dealer)[f]								•

[a]Clean air filter element when restriction indicator is red. Replace filter element after 6 cleanings or once a year.
[b]For standby generator set only.
[c]Change oil and filter after the first 100 hours of operation, then every 500 hours maximum thereafter. Change oil and filter at least once a year.
[d]Have your authorized dealer or engine distributor replace the vibration damper every 4500 hours/5 years.
[e]Drain and flush cooling system every 3000 hours/3 years when John Deere COOL-GARD II coolant is used. Otherwise every 2000 hours/2 years.
[f]Contact your dealer when thermostat or injection nozzles are suspected to be defective. Replace injection nozzles every 5000 hours and thermostat every 10000 hours.

CD03523,00002AF -19-21DEC10-1/1

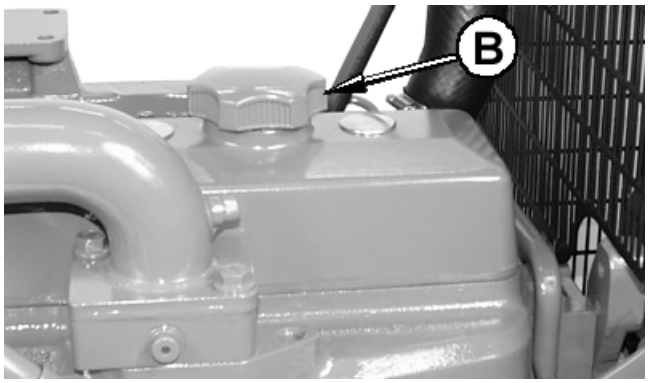
Check Engine Oil Level

3029 Engines



CD30754 —UN—26AUG99

Oil Dipstick on 3029 Engines



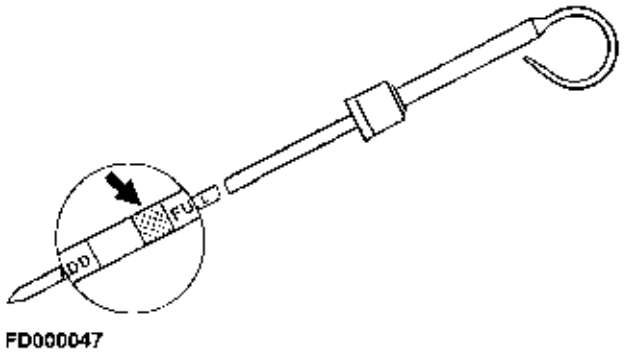
CD30755 —UN—24SEP99

Oil Filler Cap

Before starting the engine for the first time of the day, check engine oil level on dipstick (A). Add oil as required, using seasonal viscosity grade oil, at rocker arm cover filler cap (B).

IMPORTANT: DO NOT fill above the crosshatch area. Oil levels anywhere within crosshatch area are considered in the acceptable operating range.

A—Oil Dipstick **B—Oil Filler Cap**

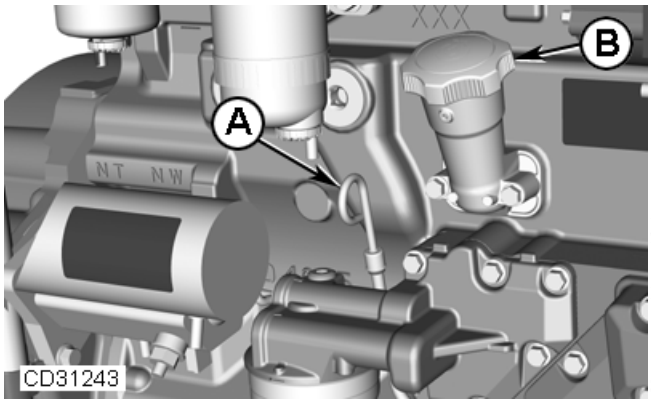


FD000047 —UN—13MAR96

Crosshatch Area on Oil Dipstick

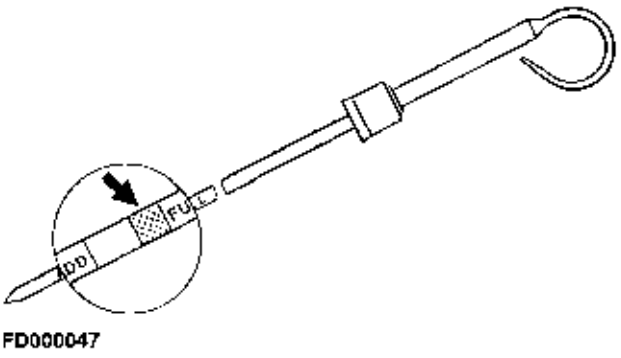
CD03523,00002B0 -19-23DEC10-1/3

4045 and 6068 Engines



CD31243 —UN—30NOV10

Oil Dipstick and Oil Filler Neck on 4045/6068 Engines



FD000047 —UN—13MAR96

Crosshatch Area on Oil Dipstick

Before starting the engine for the first time of the day, check engine oil level on dipstick (A). Add oil as required, using seasonal viscosity grade oil, at oil filler neck (B).

IMPORTANT: DO NOT fill above the crosshatch area. Oil levels anywhere within crosshatch area are considered in the acceptable operating range.

Continued on next page

CD03523,00002B0 -19-23DEC10-2/3

6090 Engines

Before starting the engine for the first time of the day, check engine oil level on oil dipstick /filler cap (A) as follows:

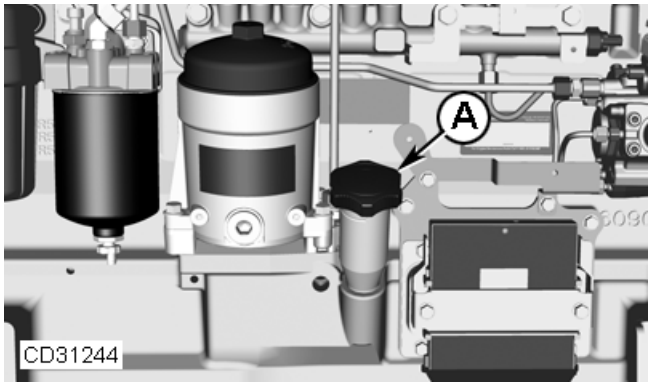
1. Remove oil dipstick/filler cap (A).
2. Wipe dipstick blade to remove oil.
3. Reinstall dipstick then tighten by hand.
4. Again remove dipstick and check oil level.

Add oil as required, using seasonal viscosity grade oil.

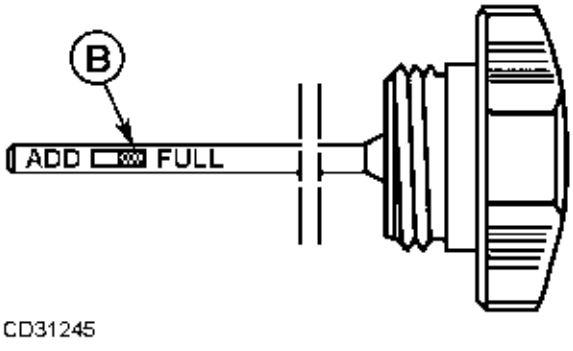
IMPORTANT: DO NOT fill above the crosshatch area (B). Oil levels anywhere within crosshatch area are considered in the acceptable operating range.

A—Oil Dipstick/Filler Cap

B—Crosshatch Area on Oil Dipstick/Filler Cap



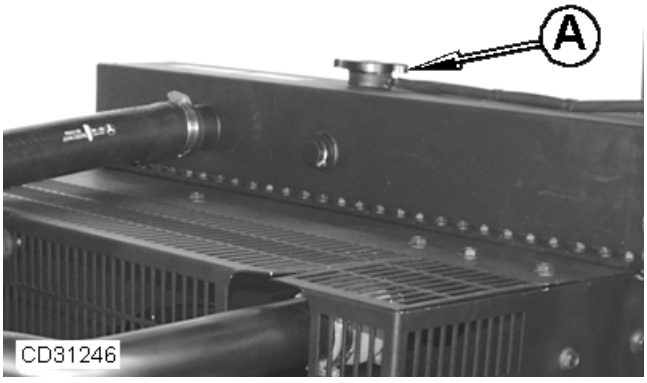
Oil Dipstick/Filler Cap



Crosshatch Area on Oil Dipstick/Filler Cap

CD03523,00002B0 -19-23DEC10-3/3

Check Coolant Level



Radiator Cap

A—Radiator Cap

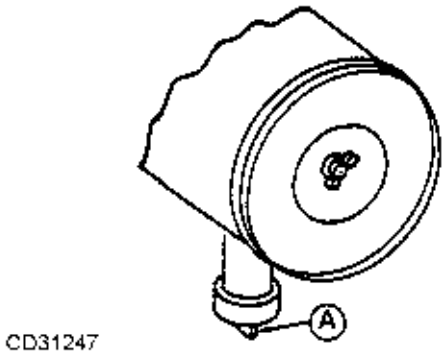
⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Only remove filler cap when engine is cold or when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Remove radiator cap (A) and check coolant level which should be at bottom of filler neck. Fill radiator with proper coolant solution if level is low. Check entire cooling system for leaks.

CD03523,00002B1 -19-03JAN11-1/1

Check Air Filter



Check Dust Unloader Valve

Check Air Restriction Indicator

A—Dust Unloader Valve **B—Air Restriction Indicator**

1. If air filter has a dust unloader valve (A), squeeze valve tip to release any trapped dirt particles.
2. Check air intake restriction indicator (B). When indicator is red, air filter needs to be cleaned.

IMPORTANT: Maximum air intake restriction is 6.25 kPa (0.06 bar) (1.0 psi) (25 in. H2O). A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.

3. Make a thorough inspection of the engine compartment.

NOTE: Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.

CD03523,00002B2 -19-23DEC10-1/1

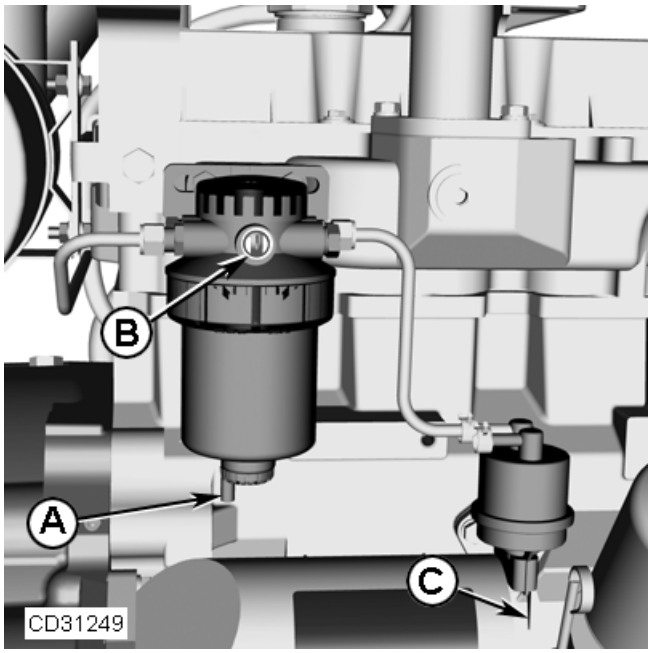
Check Fuel Filter

3029 Engines

Check the fuel filter daily for water or debris and drain as necessary.

IMPORTANT: Drain water into a suitable container and dispose of properly.

1. Loosen drain plug (A) at bottom of fuel filter two or three turns.
2. Loosen air bleed plug (B) two full turns on fuel filter base and drain water from bottom until fuel starts to drain out.
3. When fuel starts to drain out, hand tighten drain plug. After draining water from the fuel filter, the filter must be primed by bleeding all air from the fuel system.
4. Operate primer lever (C) of the fuel supply pump until fuel flow is free from air bubbles.
5. Tighten bleed plug securely by hand. Continue operating hand primer until pumping action is not felt. When finished, pull hand primer outward (away from engine) as far as it will go.



Drain Water from Fuel Filter

A—Drain Plug **C—Primer Lever**
B—Air Bleed Plug

Continued on next page

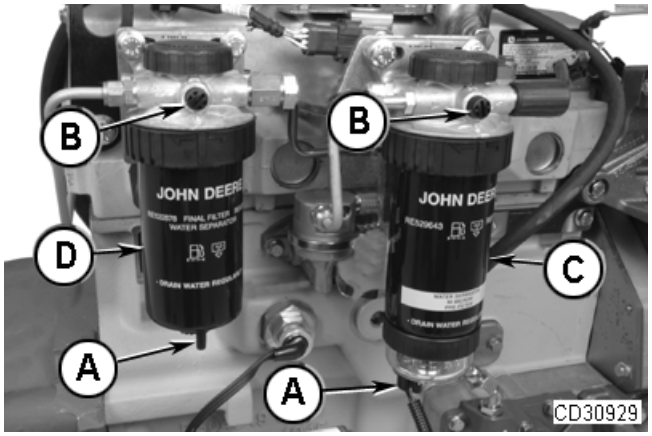
CD03523,00002B3 -19-23DEC10-1/3

4045 and 6068 Engines

NOTE: Engines have two fuel filters (primary and final) equipped with a water-in-fuel sensor. Depending on application, an indicator light on the instrument panel will signal the operator that water should be drained from filter bowls.

Check fuel filters (C) and (D) daily for water or debris and drain as necessary.

1. Loosen drain plugs (A) at bottom of both fuel filters two or three turns.
2. Loosen air bleed plugs (B) two full turns and drain water into a suitable container.
3. When fuel starts to drain out, tighten drain plugs securely.
4. Bleed fuel system.



CD30929 —UN—07FEB07

Drain Water from Fuel Filters

A—Drain Plugs
B—Air Bleed Plugs
C—Primary Fuel Filter
D—Final Fuel Filter

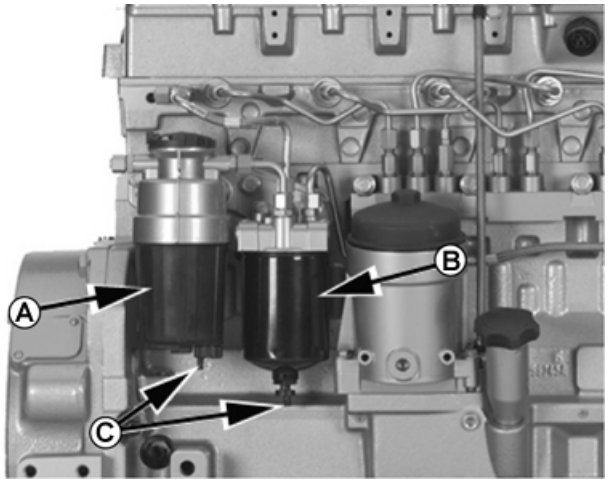
CD03523,00002B3 -19-23DEC10-2/3

6090 Engines

NOTE: Depending on application, the primary fuel filter is equipped with a sensor that detects the presence of water in the fuel filter element. This sensor will illuminate the red "STOP ENGINE" warning light on the diagnostic gauge and also sound an audible alarm. A Diagnostic Trouble Code (DTC), a description of the trouble code and the corrective action needed will be displayed on the diagnostic gauge.

Check fuel filters (A) and (B) daily for water or debris and drain as necessary.

1. Loosen drain plugs (C) at bottom of both fuel filters two or three turns.
2. Drain water into a suitable container.
3. Retighten drain plugs securely.
4. Turn ignition key to "ON" for 60 seconds to prime the fuel system before starting engine.



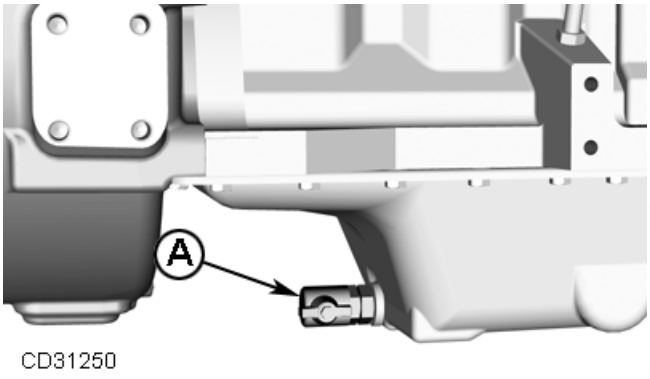
RG13845 —UN—11JAN05

Drain Water from Fuel Filters

A—Primary Fuel Filter
B—Final Fuel Filter
C—Drain Plugs

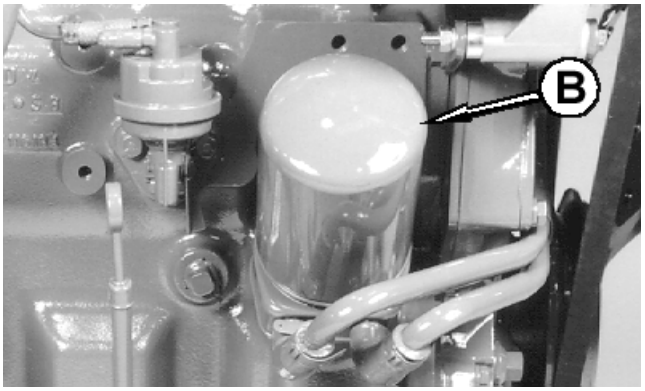
CD03523,00002B3 -19-23DEC10-3/3

Change Engine Oil and Filter (3029 Engines)



CD31250 —UN—06DEC10

Oil Pan Drain Valve on 3029 Engines



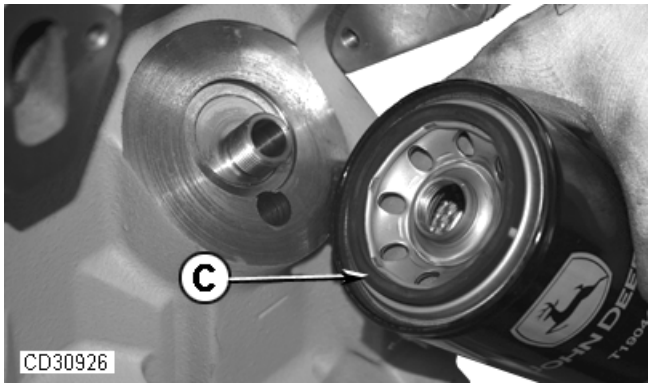
CD30760 —UN—26AUG99

Oil Filter on 3029 Engines

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

NOTE: Change engine oil and filter for the first time after 100 hours maximum of operation, then every 500 hours thereafter. Change oil and filter at least once a year.

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Open oil pan drain valve (A).
3. Drain crankcase oil from engine while warm.
4. Replace oil filter as follows:
   a. Remove and discard oil filter element (B) using a suitable filter wrench.
   b. Oil packing (C) and install new filter element. Hand tighten element according to values printed on filter element. If values are not provided, tighten element approximately 3/4 — 1-1/4 turn after packing contacts filter housing. DO NOT overtighten filter element.



CD30926 —UN—30JAN07

Oil Filter Packing

A—Oil Pan Drain Valve
B—Oil Filter Element
C—Oil Filter Packing

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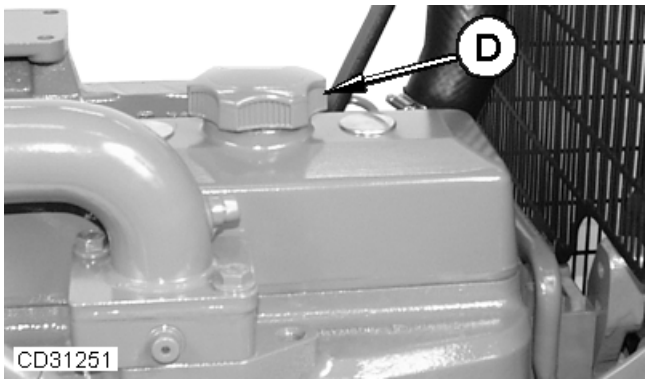
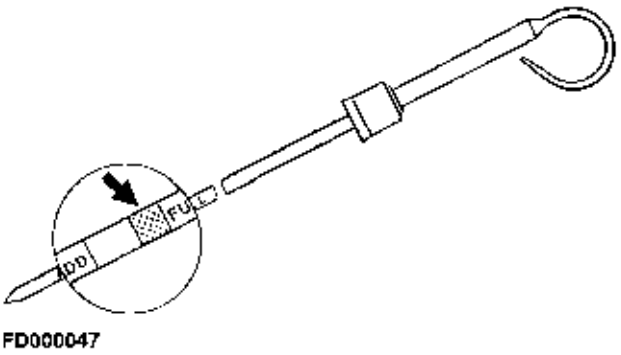
CD03523,00002B4 -19-23DEC10-1/2



CD31251 —UN—06DEC10

Oil Filler Cap



FD000047 —UN—13MAR96

Crosshatch Area on Oil Dipstick

D—Oil Filler Cap

5. Close oil pan drain valve.
6. Fill engine crankcase with correct John Deere engine oil through opening on rocker arm cover (D).

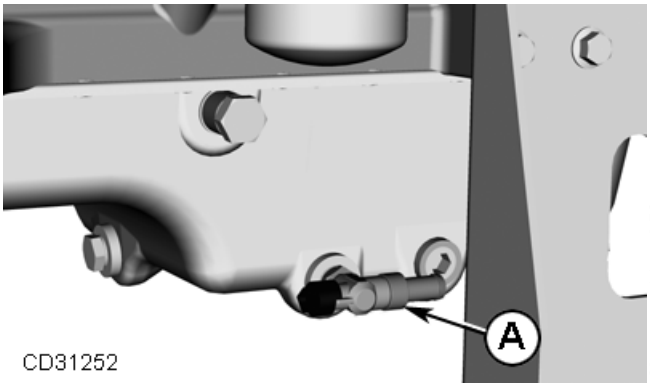
   To determine the correct oil fill quantity for your engine, see the Specifications Section.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch area on dipstick, whichever is present. DO NOT overfill.

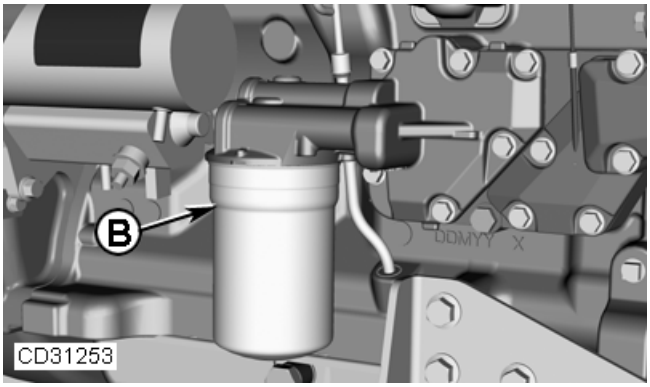
7. Start engine and run to check for possible leaks.
8. Stop engine and check oil level after 10 minutes. If necessary, top up.

CD03523,00002B4 -19-23DEC10-2/2

Change Engine Oil and Filter (4045 and 6068 Engines)



Oil Pan Drain Valve on 4045/6068 Engines



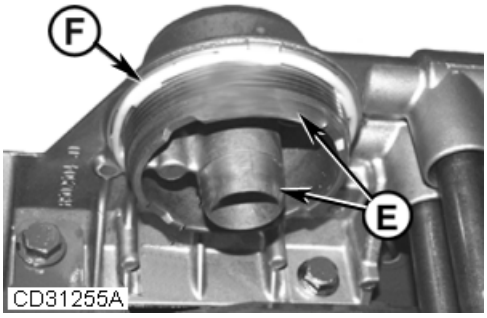
Oil Filter on 4045/6068 Engines

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

NOTE: Change engine oil and filter for the first time after 100 hours maximum of operation, then every 500 hours thereafter. Change oil and filter at least once a year.

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Open oil pan drain valve (A).
3. Drain crankcase oil from engine while warm.
4. Replace oil filter as follows:
   a. Remove and discard oil filter element (B) using a suitable filter wrench.
   b. Apply clean engine oil to inner (C) and outer (D) seals and to filter threads.
   c. Wipe both sealing surfaces (E) of the filter header with a clean rag. Ensure notches in dust seal (F) are properly installed in the slots in the housing. Replace dust seal if damaged.
   d. Install and tighten oil filter by hand until it is tight against dust seal (F). DO NOT overtighten.
5. Close oil pan drain valve.

Oil Filter Seals



Oil Filter Header

A—Oil Drain Valve
B—Oil Filter Element
C—Inner Seal
D—Outer Seal
E—Sealing Surfaces
F—Dust Seal

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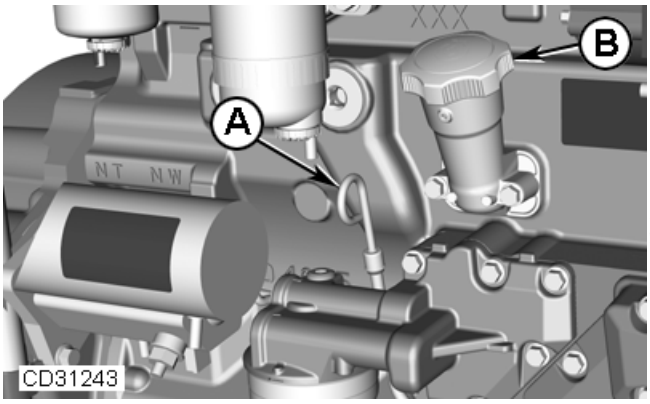
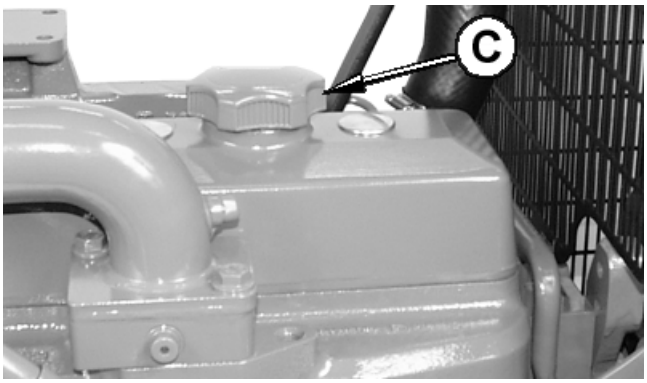
CD03523,00002B5 -19-23DEC10-1/2



CD31243 —UN—30NOV10

Oil Filler Cap and Dipstick on 4045/6068 Engines



CD30761 —UN—24SEP99

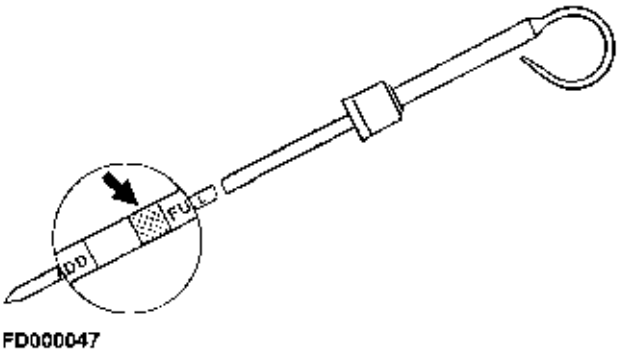
Oil Filler Cap on Rocker Arm Cover

6. Fill engine crankcase with correct John Deere engine oil through opening on rocker arm cover (C) or on the side of the engine (B).

   To determine the correct oil fill quantity for your engine, see the Specifications Section.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch area on dipstick (A), whichever is present. DO NOT overfill.

7. Start engine and run to check for possible leaks.
8. Stop engine and check oil level after 10 minutes. If necessary, top up.



FD000047 —UN—13MAR96

Crosshatch Area on Oil Dipstick

A—Oil Dipstick
B—Oil Filler Cap on Side of Engine
C—Oil Filler Cap on Rocker Arm Cover

CD03523,00002B5 -19-23DEC10-2/2

Change Engine Oil and Filter (6090 Engines)

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

NOTE: Change engine oil and filter for the first time after 100 hours maximum of operation, then every 500 hours thereafter. Change oil and filter at least once a year.

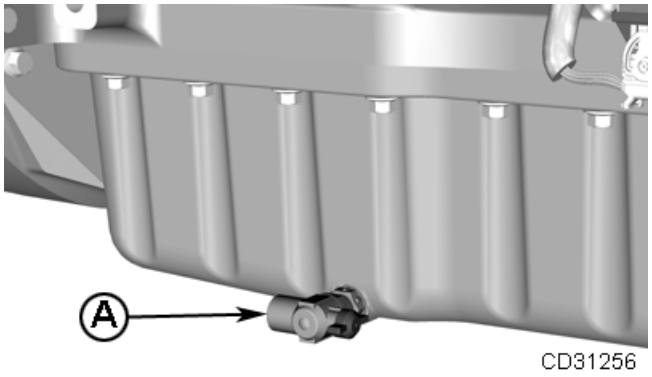
1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Open oil pan drain valve (A).
3. Drain crankcase oil from engine while warm.

NOTE: Do NOT remove plug (B). Plug (B) is not an oil drain. Oil in filter will drain down automatically as filter cap is loosened.

4. Loosen filter cap (C) one-half turn with wrench. Wait 30 seconds to allow oil filter housing to drain. Remove cap and filter assembly.
5. While holding cap, strike filter element against solid surface as shown to unfasten filter from cap. Discard used filter.
6. Remove O-ring seal, and replace with new O-ring provided with new filter element.
7. Press new filter element into cap until it snaps into place.
8. Insert cap and filter assembly into oil filter housing. Screw cap into place.
9. Tighten cap to specifications.

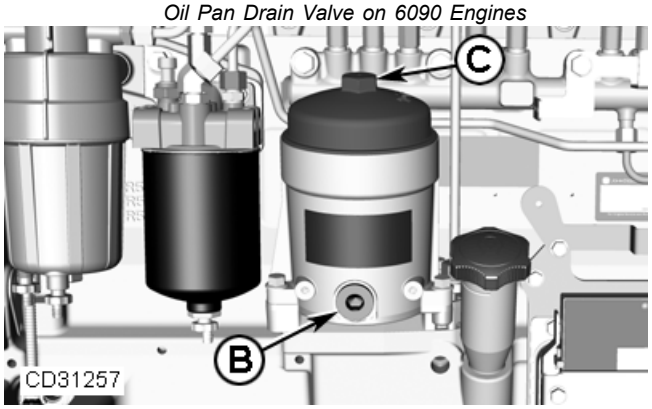
Specification	
Top-Load Oil Filter Cap—Torque	45 N·m (33 lb.-ft.)

A—Oil Pan Drain Valve
B—Plug (DO NOT REMOVE)
C—Oil Filter Cap



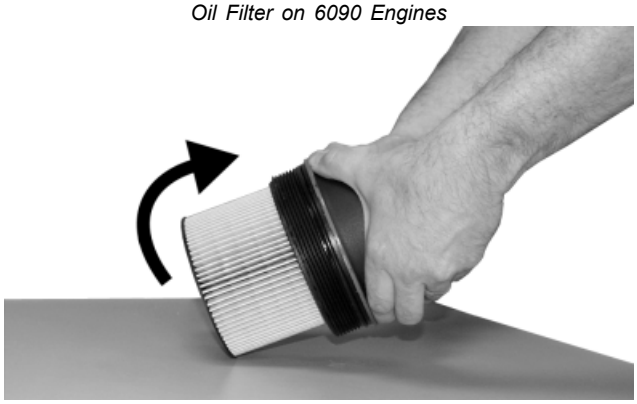
CD31256 —UN—06DEC10

Oil Pan Drain Valve on 6090 Engines



CD31257 —UN—06DEC10

Oil Filter on 6090 Engines



RG11628 —UN—01FEB01

Remove Filter Element from Cap

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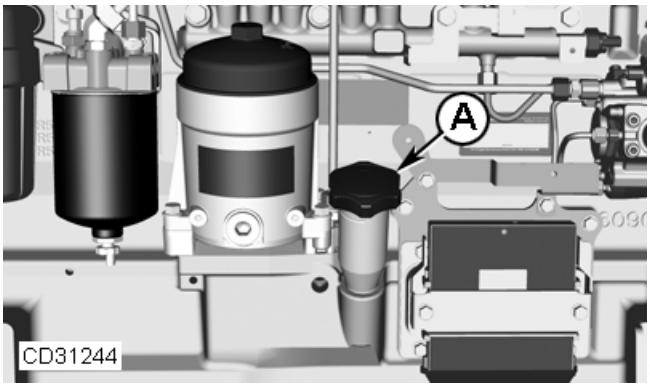
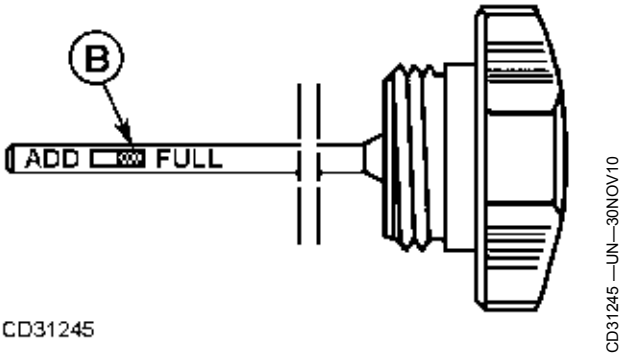


Oil Dipstick/Filler Cap

A—Oil Dipstick/Filler Cap



Crosshatch Area on Oil Dipstick/Filler Cap

B—Crosshatch Area on Oil Dipstick/Filler Cap

10. Close oil pan drain valve.
11. Remove oil dipstick/filler cap (A) and fill engine crankcase with correct John Deere engine oil.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch area on dipstick (B), whichever is present. DO NOT overfill.

To determine the correct oil fill quantity for your engine, see the Specifications Section.

To check oil level, proceed as follows:

a. Remove oil dipstick/filler cap (A).

b. Wipe dipstick blade to remove oil.

c. Reinstall dipstick then tighten by hand.

d. Again remove dipstick and check oil level.

IMPORTANT: Immediately after completing any oil change, crank engine for 30 seconds without permitting engine to start. This will help insure adequate lubrication to engine components before engine starts.

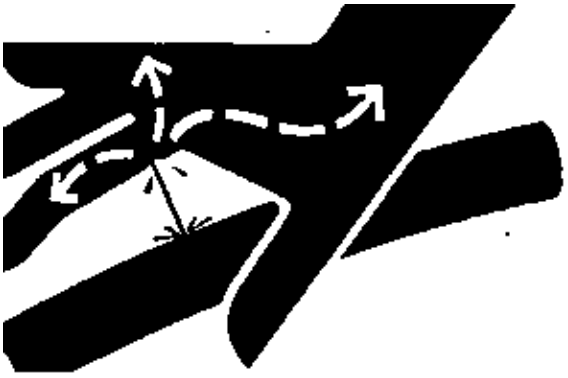
12. Start engine and run to check for possible leaks.
13. Stop engine and check oil level after 10 minutes. Oil level reading should be on upper mark of dipstick.

CD03523,00002B6 -19-23DEC10-2/2

Change Fuel Filter Element (3029 Engines)

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



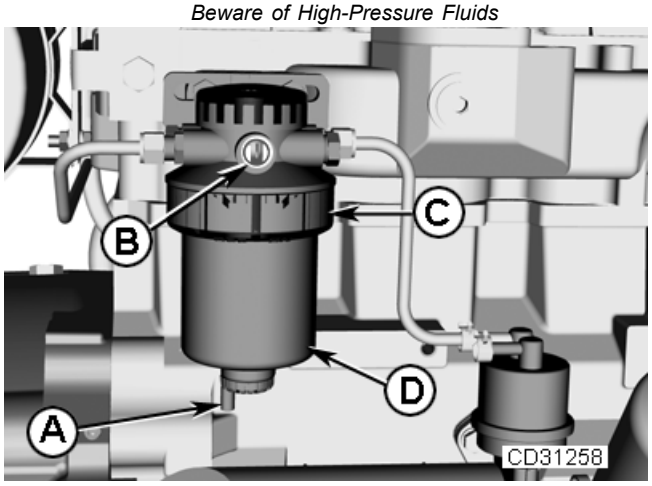
X9811 —UN—23AUG88

Beware of High-Pressure Fluids

1. Thoroughly clean fuel filter assembly and surrounding area.
2. Loosen drain plug (A) and air bleed plug (B). Drain fuel into a suitable container.

NOTE: Lifting up on retaining ring as it is rotated helps to get it past raised locators.

3. Firmly grasp the retaining ring (C) and rotate it clockwise 1/4 turn. Remove ring with filter element (D).
4. Save retaining ring and (if equipped) water separator bowl for reuse.



CD31258 —UN—07DEC10

A—Drain Plug
B—Air Bleed Plug
C—Retaining Ring
D—Fuel Filter Element

IMPORTANT: Do not dump the old fuel into the new filter element. This could cause fuel injection problems.

A plug is provided with the new element for plugging the used element.

5. Inspect filter mounting base for cleanliness. Clean as required.

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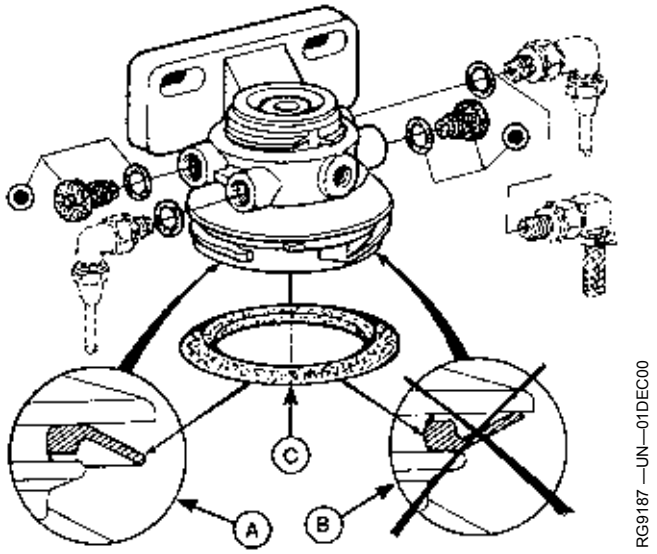
CD03523,00002B7 -19-23DEC10-1/2

6. Inspect condition of dust seal (C). Replace if necessary. Install dust seal as shown.

NOTE: Proper installation is indicated when a "click" is heard and a release of pressure on the ring is felt.

7. Align keys on filter element with slots in filter base, then tighten retaining ring counterclockwise 1/4 turn until it "snaps" into the detent. DO NOT overtighten.
8. If equipped with water separator, remove water separator bowl from removed filter element. Drain and clean separator bowl. Dry with compressed air. Install water separator bowl onto new element. Tighten securely.
9. Bleed the fuel system.

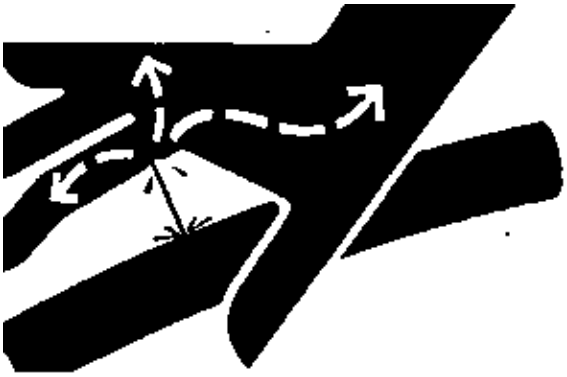
A—Correct Installation
B—Incorrect Installation
C—Dust Seal



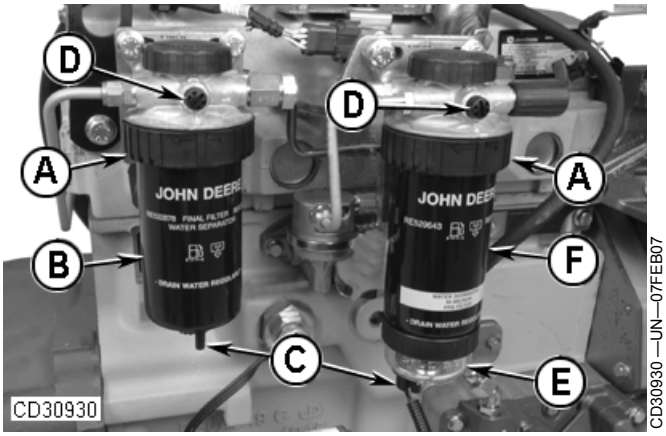
Fuel Filter Dust Seal Installation

CD03523,00002B7 -19-23DEC10-2/2

Change Fuel Filter Elements (4045 and 6068 Engines)



X9811 —UN—23AUG88



CD30930 —UN—07FEB07

Fuel Filters

A—Retaining Ring
B—Final Fuel Filter Element
C—Drain Plug
D—Bleed Plug
E—Water Separator Bowl
F—Primary Fuel Filter Element

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

NOTE: Engines are equipped with a primary fuel filter (F) and a final fuel filter (B). Both fuel filters have to be replaced together at the same time.

1. Thoroughly clean fuel filter assembly and surrounding area.
2. Disconnect water-in-fuel sensor wiring.
3. Loosen drain plug (C) and drain fuel into a suitable container.

NOTE: Lifting up on retaining ring as it is rotated helps to get it past raised locators.

4. Firmly grasp the retaining ring (A) and rotate it clockwise 1/3 turn. Remove ring along with filter element (B) or (F).

IMPORTANT: Do not dump the old fuel into the new filter element. This could cause fuel injection problems.

A plug is provided with the new element for plugging the used element.

5. Inspect filter mounting base for cleanliness. Clean as required.

NOTE: Raised locators on fuel filter canister must be indexed properly with slots in mounting base for correct installation.

6. Install new filter element dry onto mounting base. Be sure element is properly indexed and firmly seated on base. It may be necessary to rotate filter for correct alignment.

   If equipped with water separator bowl (E), remove filter element from separator bowl. Drain and clean separator bowl. Dry with compressed air. Install bowl onto new filter element. Tighten securely.

7. Install retaining ring onto mounting base making certain dust seal is in place on filter base. Hand tighten ring (about 1/3 turn) until it ”snaps” into the detent. DO NOT overtighten retaining ring.

NOTE: The proper installation is indicated when a "click" is heard and a release of the retaining ring is felt.

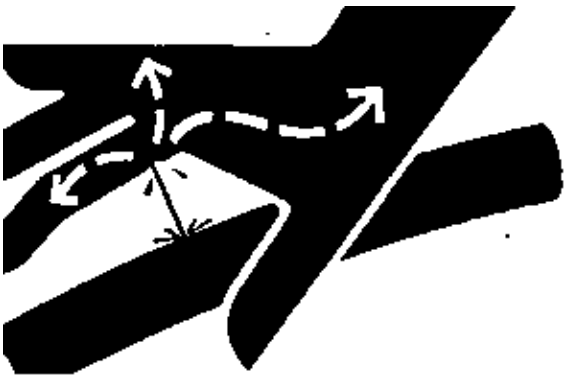
8. Bleed the fuel system.

CD03523,00002B8 -19-23DEC10-1/1

Change Fuel Filter Elements (6090 Engines)

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



X9811 —UN—23AUG88

High Pressure Fluids

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CD03523,00002B9 -19-23DEC10-1/3

Remove and Install Primary Fuel Filter Element

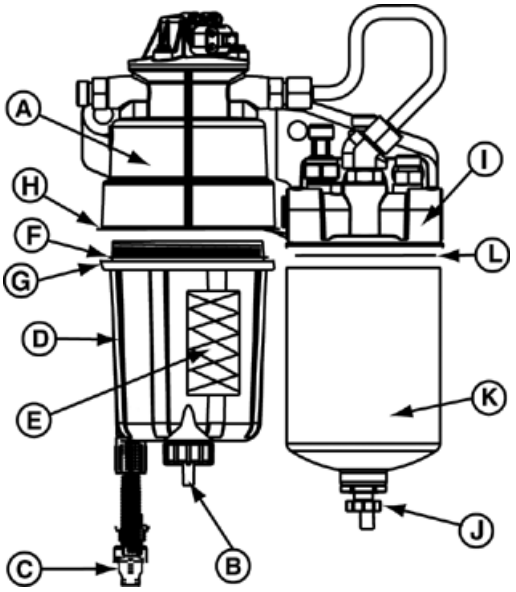
CAUTION: Due to High Pressure Common Rail system design, fuel in filter is likely to be under high pressure. To avoid possible personal harm, open valves (B) and (J) on bottom of filters to relieve pressure prior to removing each filter.

NOTE: Engines are equipped with a primary fuel filter (A) and a final fuel filter (I). Both fuel filters have to be replaced together at the same time. Replace fuel filter elements anytime audible alarm sounds and trouble codes indicate plugged fuel filters (low fuel pressure). If no alarm sounds during the 12 month service interval, replace elements at that time, or after 500 hours operation, whichever comes first.

1. Thoroughly clean primary filter header (A) and surrounding area to prevent dirt and debris from getting into fuel system.
2. Connect a fuel drain line to primary filter drain valve (B) on bottom of filter and drain all fuel from the primary filter canister (D).
3. Disconnect water-in-fuel sensor connector (C).
4. Turn primary filter canister (D) counterclockwise (CCW) to remove.
5. Once primary filter canister (D) is removed, pull primary filter element (E) down to remove from primary filter header (A).
6. Inspect primary filter header (A) and primary filter canister (D) sealing surfaces. Clean as required.
7. Place new packing (F) on primary filter canister (D).
8. Place thin film of fuel on primary filter packing (F).

IMPORTANT: Do NOT pre-fill filter with fuel. This may introduce debris into the fuel system.

9. Place new primary filter element (E) in canister (D) with tangs on bottom going into canister.



RG14250 —UN—06JUN05

A—Primary Filter Header
B—Primary Filter Canister Drain Valve
C—Water-In-Fuel Sensor Connector
D—Primary Filter Canister
E—Primary Filter Element
F—Primary Filter Packing
G—Primary Filter Canister Lip
H—Primary Filter Header Lip
I— Final Fuel Filter Header
J— Final Filter Drain Valve
K—Final Fuel Filter
L—Final Filter Packing

10. Screw canister (D) into filter header (A) and turn clockwise (CW). Tighten until canister lip (G) snugly mates with header lip (H).
11. Turn filter additional 3/4 turn after seal contact with header.
12. Connect water-in-fuel sensor connector (C).

NOTE: Be sure to also replace final fuel filter and then prime system (see following).

Continued on next page

Remove and Install Final Fuel Filter

CAUTION: Due to High Pressure Common Rail system design, fuel in filter is likely to be under high pressure. To avoid possible personal harm, open valves (B) and (J) on bottom of filters to relieve pressure prior to removing each filter.

NOTE: Engines are equipped with a primary fuel filter (A) and a final fuel filter (I). Both fuel filters have to be replaced together at the same time. Replace fuel filter elements anytime audible alarm sounds and trouble codes indicate plugged fuel filters (low fuel pressure). If no alarm sounds during the 12 month service interval, replace elements at that time, or after 500 hours operation, whichever comes first.

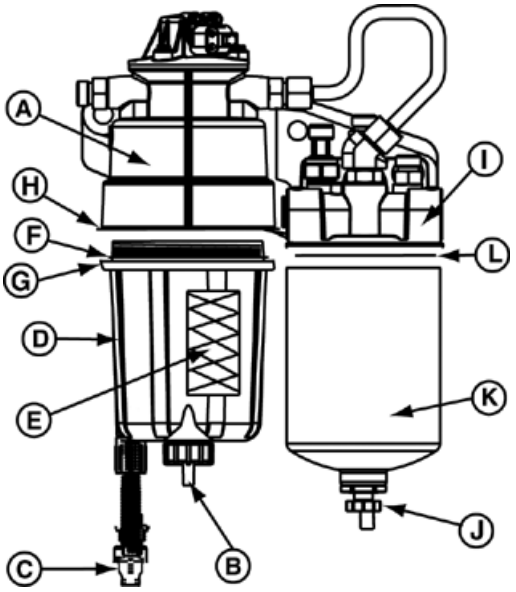
1. Thoroughly clean final filter header (I) and surrounding area to prevent dirt and debris from getting into fuel system.
2. Connect a fuel drain line to final filter drain valve (J) on bottom of filter and drain all fuel from the filter.
3. Turn final filter (K) counterclockwise (CCW) to remove.
4. Inspect final filter header (I) sealing surface. Clean as required.
5. Install new final filter fuel drain valve (J), tighten to specification.

Specification	
Final Fuel Filter Drain Valve—Torque	3.4—4 Nm (30—35 lb.-in.)

6. Place new final filter packing (L) on filter.
7. Place thin film of fuel on packing (L).

IMPORTANT: Do NOT pre-fill filter with fuel. This may introduce debris into the fuel system.

NOTE: Final filter replacement instructions are printed on the new filter.



RG14250 —UN—06JUN05

A—Primary Filter Header
B—Primary Filter Canister Drain Valve
C—Water-In-Fuel Sensor Connector
D—Primary Filter Canister
E—Primary Filter Element
F—Primary Filter Packing
G—Primary Filter Canister Lip
H—Primary Filter Header Lip
I— Final Fuel Filter Header
J— Final Filter Drain Valve
K—Final Fuel Filter
L—Final Filter Packing

8. Screw final fuel filter (K) into final fuel filter header (I) and turn clockwise (CW). Tighten until final fuel filter (K) snugly mates with final fuel filer header (I).
9. Turn filter additional 3/4 turn after seal contact with header.

NOTE: Turn ignition Key to ON for 60 seconds to prime the fuel system before starting engine. It may be necessary to turn key off and on again to reprime the system before starting.

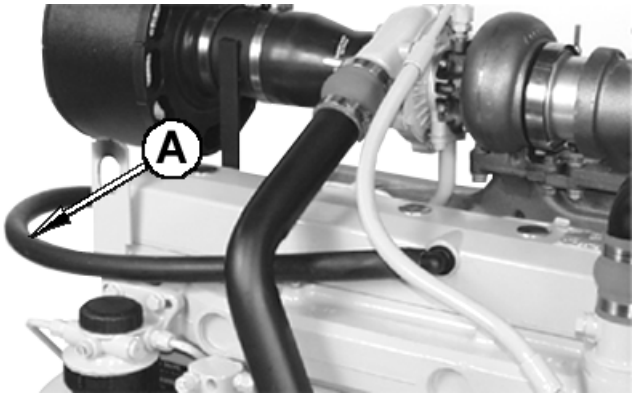
CD03523,00002B9 -19-23DEC10-3/3

Check Crankcase Vent System

If you operate the engine in dusty conditions, clean the tube at shorter intervals.

1. Remove and clean crankcase vent tube (A).
2. Install the vent tube. Be sure the O-ring fits correctly in the rocker arm cover for elbow adapter. Tighten hose clamp securely.

A—Crankcase Vent Tube



CD30773 —UN—27AUG99

Crankcase Vent System

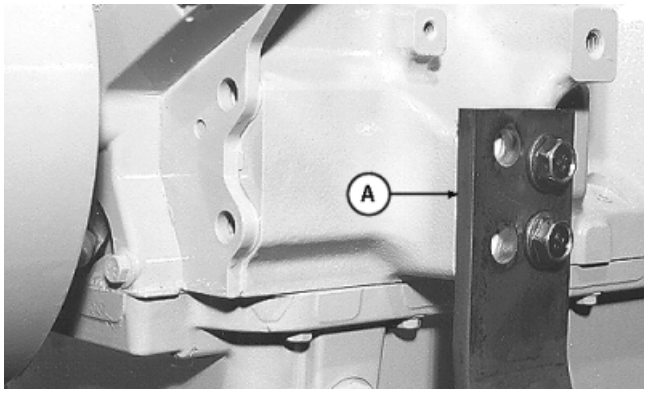
CD03523,00002C0 -19-23DEC10-1/1

Check Engine Mounts

Engine mounting is the responsibility of the vehicle or generator manufacturer. Follow manufacturer's guidelines for mounting specifications.

IMPORTANT: Use only Grade SAE 8 or higher grade of hardware for engine mounting.

1. Check the engine mounting brackets (A), vibration isolators, and mounting bolts on support frame and engine block for tightness. Tighten as necessary.
2. Inspect overall condition of vibration isolators, if equipped. Replace isolators, as necessary, if rubber has deteriorated or is crushed due to a loss of elasticity.



Engine Mounting

A—Mounting Bracket

CD03523,00002C3 -19-23DEC10-1/1

Check Engine Electrical Ground Connections

Keep all engine ground connections clean and tight to prevent electrical arcing which can damage engine or electronic components.

CD03523,00002C4 -19-23DEC10-1/1

Check Belt (3029 Engines)

1. Inspect belt for cracks, fraying, or stretched out areas. Replace as necessary.
2. Check belt tension using one of following methods:

   a) Use of JDG529 Tension Gauge (A)

Specification	
Belt tension—New belt	578—622 N (130—140 lb.-force)
Used belt	378—423 N (85—94 lb.-force)

NOTE: Belt is considered used after 10 minutes of operation.

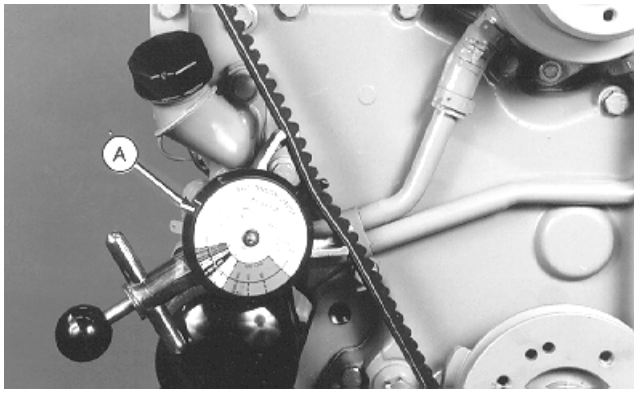
   b) Use of tension tester (B) and straight edge (C)
   A 89 N (20 lb.) force applied halfway between pulleys should deflect belt by 19 mm (0.75 in.).

3. If adjustment is necessary, loosen alternator nuts (D) and (E). Pull alternator frame outward until belt is correctly tensioned.

IMPORTANT: Do not pry against the alternator rear frame. Do not tighten or loosen belts while they are hot.

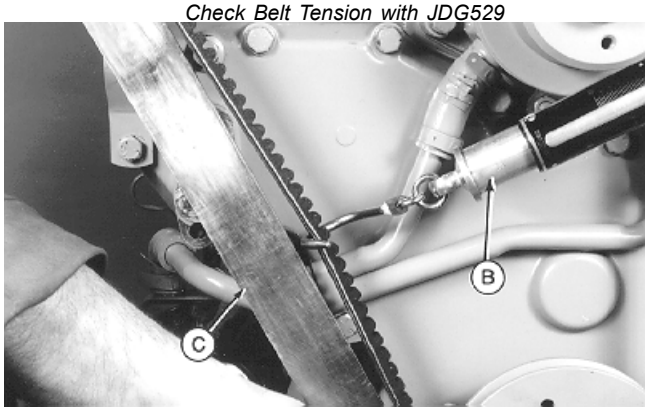
4. Tighten alternator bracket nuts firmly.
5. Run engine for 10 minutes then recheck belt tension.

A—JDG529 Tension Gauge
B—Tension Tester
C—Straight Edge
D—Upper Nut
E—Lower Nut



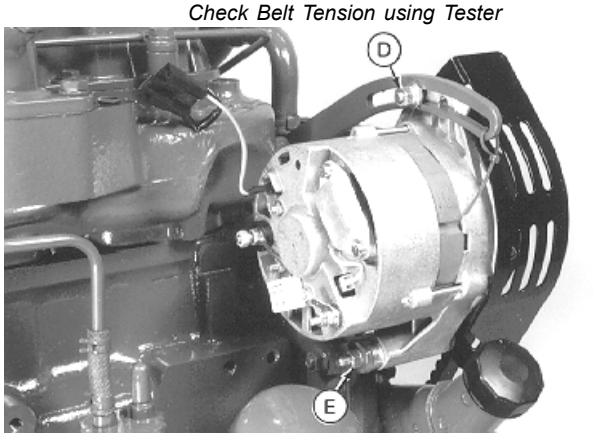
CD30644 —UN—04MAY98

Check Belt Tension with JDG529



CD30645 —UN—04MAY98

Check Belt Tension using Tester

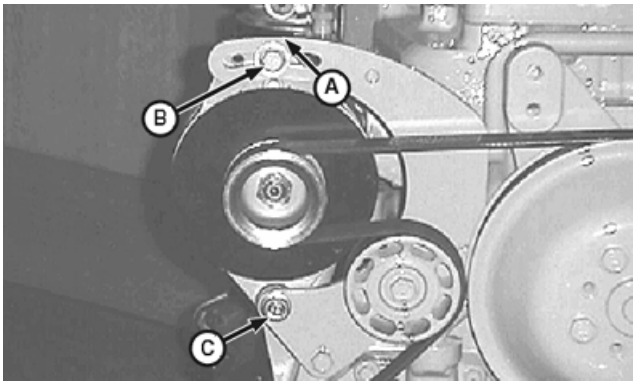


CD30646 —UN—04MAY98

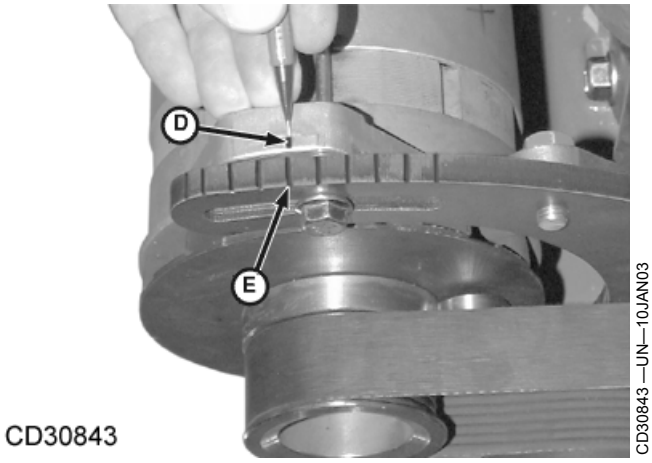
Alternator Fastening

CD03523,00002BA -19-15DEC10-1/1

Check Belt (4045 and 6068 Engines with Manual Tensioner)



Manual Belt Tensioner on 4045 and 6068 Engines



Reference Marks

A—Belt Gauge
B—Cap Screw
C—Cap Screw
D—Reference Mark
E—Alternator Upper Bracket Notch

Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.

NOTE: Belt adjustment is measured using a gauge stamped on the top edge of the alternator bracket.

1. Loosen cap screws (B) and (C).
2. Slide alternator in slot by hand to remove all excess slack in belt. Scribe a reference mark (D) on line with notch (E) on upper alternator bracket.

IMPORTANT: Do not pry against alternator rear frame.

3. Using the gauge (A) on the alternator bracket, stretch belt by prying outward on alternator front frame. Stretch the belt 1 gauge unit for a used belt and 1.5 gauge units for a new belt.
4. Tighten cap screws (B) and (C).

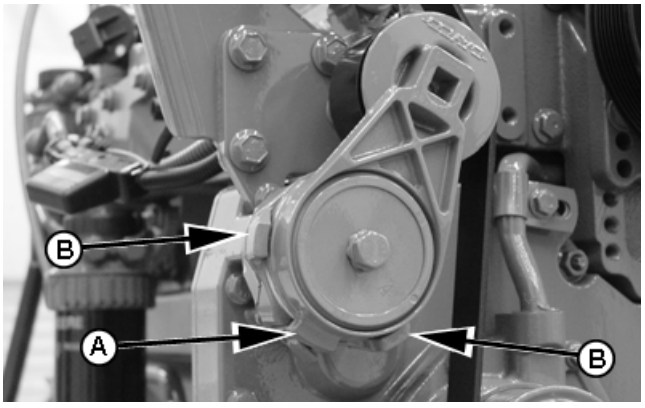
CD03523,00002BB -19-10DEC10-1/1

Check Belt (4045 and 6068 Engines with Automatic Tensioner)

NOTE: With the belt loosened, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.

Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

- **Check belt wear**
  The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry is used. If the tensioner stop on swing arm (A) is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed (see Replace Fan and Alternator Belt, Maintenance/As Required Section).



Automatic Belt Tensioner

A—Tensioner Stop
B—Fixed Stop

Continued on next page

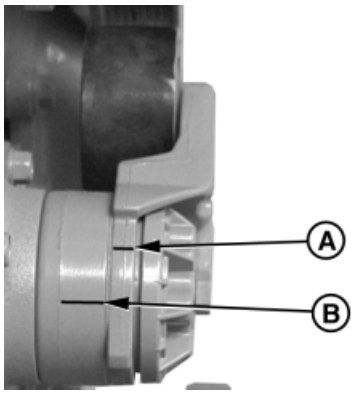
CD03523,00002BC -19-10DEC10-1/2

- **Check tensioner spring tension**
  A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:
  a. Release tension on belt using a long-handled 1/2 inch drive tool in tensioner arm. Remove belt from pulleys.
  b. Release tension on tensioner arm and remove drive tool.
  c. Put a mark (A) on swing arm of tensioner as shown.
  d. Measure 21 mm (0.83 in.) from mark (A) and put a mark (B) on tensioner mounting base.
  e. Install torque wrench in square hole so that it is aligned with center of roller and tensioner as shown. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
  f. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

Specification

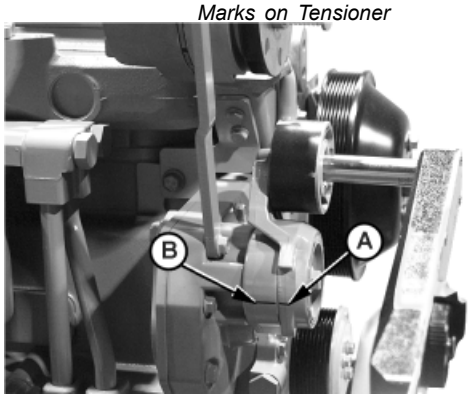
Spring—Force..... 18—22 N·m (13—16 lb.-ft.)

A—Mark on Swing Arm **B—Mark on Tensioner Mounting Base**



Marks on Tensioner

RG7977 —UN—14NOV97



Align Marks

RG12054 —UN—08JAN02

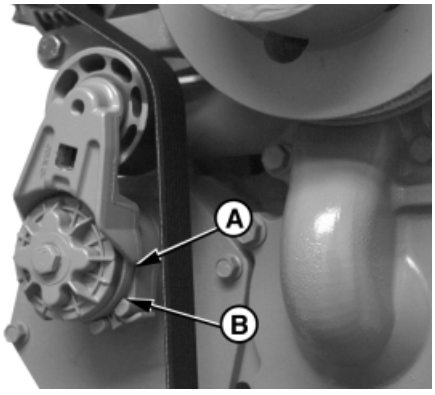
CD03523,00002BC -19-10DEC10-2/2

Check Belt (6090 Engines with Automatic Tensioner)

NOTE: With the belt loosened, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.

Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

- **Check belt wear**
  The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry is used. If the tensioner stop (A) on swing arm is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed (see Replace Fan and Alternator Belt, Maintenance/As Required Section).



Automatic Belt Tensioner

RG7380 —UN—28NOV97

A—Tensioner Stop **B—Fixed Stop**

Continued on next page

CD03523,00002BD -19-10DEC10-1/2

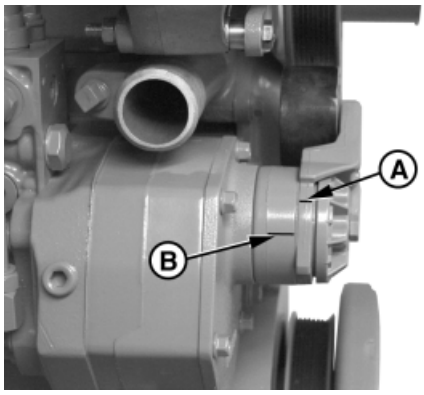
- **Check tensioner spring tension**
  A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:
  a. Release tension on belt using a long-handled 1/2 inch drive tool in tensioner arm. Remove belt from pulleys.
  b. Release tension on tensioner arm and remove drive tool.
  c. Put a mark (A) on swing arm of tensioner as shown.
  d. Measure 21 mm (0.83 in.) from mark (A) and put a mark (B) on tensioner mounting base.
  e. Install torque wrench in square hole so that it is aligned with center of roller and tensioner as shown. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
  f. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

Specification

Spring—Force..... 18—22 N·m (13—16 lb.-ft.)

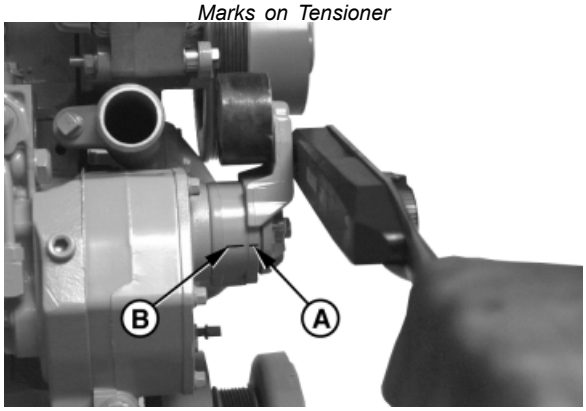
A—Mark on Swing Arm

B—Mark on Tensioner Mounting Base



RG7382 —UN—28NOV97

Marks on Tensioner

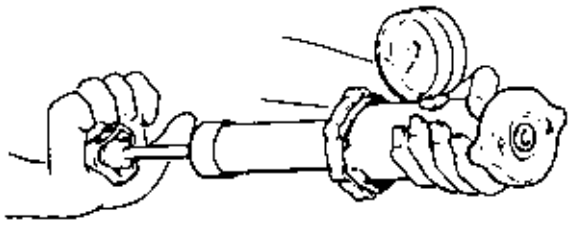


RG7381 —UN—28NOV97

Align Marks

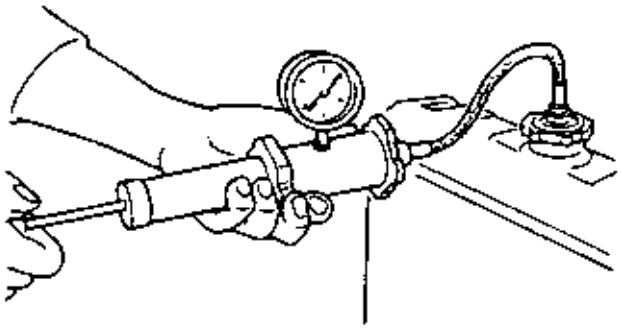
CD03523,00002BD -19-10DEC10-2/2

Check Cooling System



Test Radiador Cap

RG6557 —UN—20JAN93



RG6558 —UN—20JAN93

Test Cooling System

⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engines. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Test Radiator Cap

1. Remove radiator cap and attach to D05104ST tester as shown.
2. Pressurize cap to specification listed. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

   If gauge does not hold pressure, replace radiator cap.

Specification

Radiator Cap
Calibration—Pressure..... 100 kPa (1.00 bar) (14,5 psi) for 10 seconds minimum

3. Remove the cap from gauge, turn it 180°, and retest cap to confirm measurement.

Test Cooling System

NOTE: Engine should be warmed up to test overall cooling system.

1. Allow engines to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

IMPORTANT: DO NOT apply excessive pressure to cooling system, doing so may damage radiator and hoses.

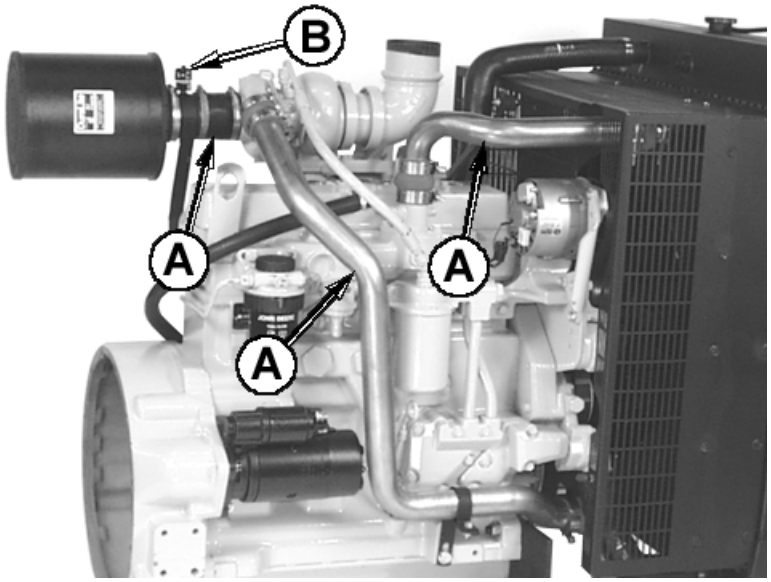
3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system to specification listed for radiator cap.
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

   If leakage is detected, correct as necessary and test system pressure again.

   If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to-head gasket. Have your engine distributor or servicing dealer correct this problem immediately.

CD03523,00002BE -19-23DEC10-1/1

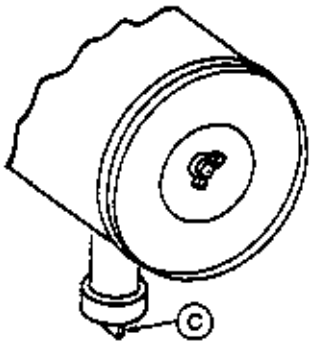
Check Air Intake System



CD30762 —UN—27AUG99

IMPORTANT: The air intake system must not leak. Any leak, no matter how small, may result in engine failure due to abrasive dirt and dust entering the intake system.

1. Inspect all intake hoses (piping) for cracks. Replace as necessary.
2. Check clamps on air pipes (A) which connect the air filter, engine and, if present, turbocharger and air-to-air radiator. Tighten clamps as necessary.
3. Test air restriction indicator (B) for proper operation. Replace indicator as necessary.
4. If engine has a rubber dust unloader valve (C), inspect the valve on bottom of air filter for cracks or plugging. Replace as necessary.
5. Service air filter as necessary.

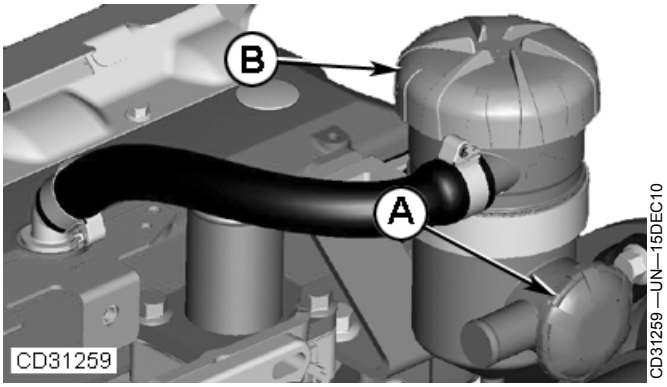


RG4687 —UN—20DEC88

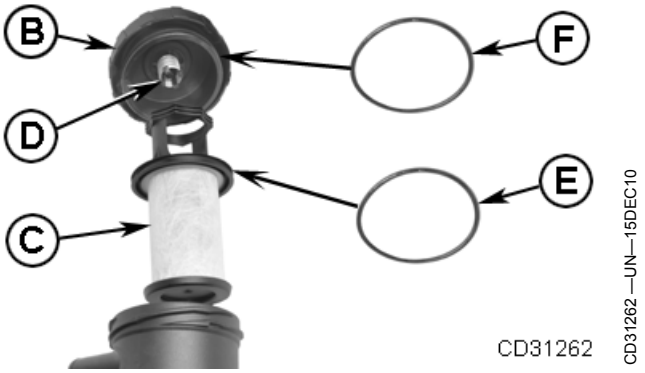
A—Air Pipes
B—Air Restriction Indicator
C—Dust Unloader Valve

CD03523,00002BF -19-15DEC10-1/1

Replace Crankcase Vent Filter (Optional)



Crankcase Vent Filter



Install New Crankcase Vent Filter Element

A—Side Cap (DO NOT REMOVE)
B—Top Cap
C—Filter Element
D—Blow-Off Valve
E—Filter Element O-Ring
F—Cap O-Ring

IMPORTANT: Do not remove the cap (A), otherwise crankcase vent filter will be irremediably destroyed.

1. Remove top cap (B) and filter element (C).
2. Clean filter canister.
3. Check blow-off valve (D) for proper operation.
4. Install a new filter element with O-ring (E).
5. Install new O-ring (F) onto top cap (B) and then reinstall the cap. Tighten securely.

CD03523,00002C1 -19-23DEC10-1/1

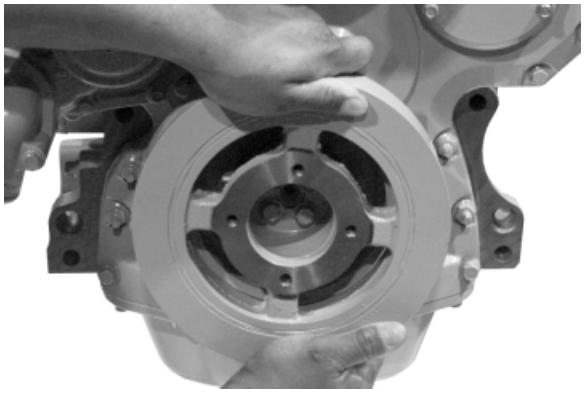
Check Crankshaft Vibration Damper (6068 and 6090 Engines)

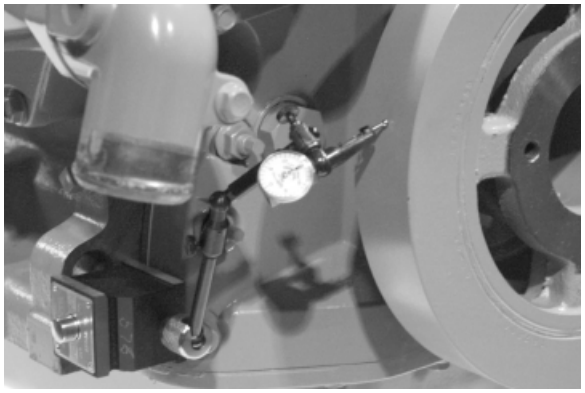
1. Remove belts (shown removed).
2. Grasp vibration damper with both hands and attempt to turn it in both directions. If rotation is felt, damper is defective and should be replaced.

IMPORTANT: The vibration damper assembly is not repairable and should be replaced every 4500 hours or 5 years, whichever occurs first.

3. Check vibration damper radial runout by positioning a dial indicator so probe contacts damper outer circumference.
4. With engine at operating temperature, rotate crankshaft using JDG820 or JDE83 Flywheel Turning Tool.
5. Note dial indicator reading. If runout exceeds specifications given below, replace vibration damper.

Specification	
Damper—Maximum radial runout	1.50 mm (0.060 in.)





CD03523,00002C2 -19-23DEC10-1/1

Check Engine Speed (3029 Engines)

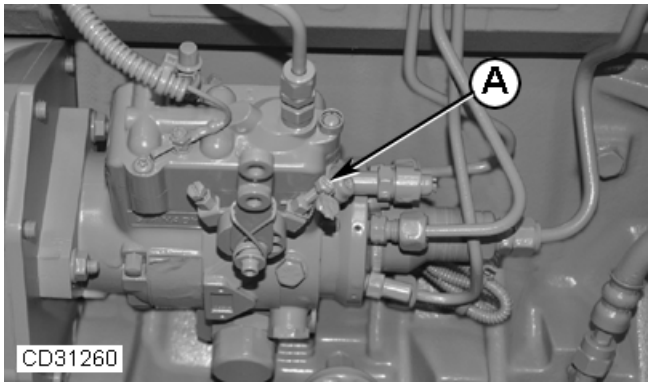
NOTE: Most engines for generator set application (1500 rpm for 50 Hz or 1800 rpm for 60 Hz) run only at fast idle and therefore they do not have slow idle.

Specification

Fast Idle—50 Hz Generator Set	1550—1580 rpm
60 Hz Generator Set	1865—1890 rpm

NOTE: Fast idle is settled by the factory and then the idle adjusting screw (A) is sealed to prevent from tampering. Fast idle adjustment can only be done by an authorized fuel system agent.

A—Fast Idle Adjusting Screw



CD31260 —UN—10DEC10

Fast Idle Adjusting Screw

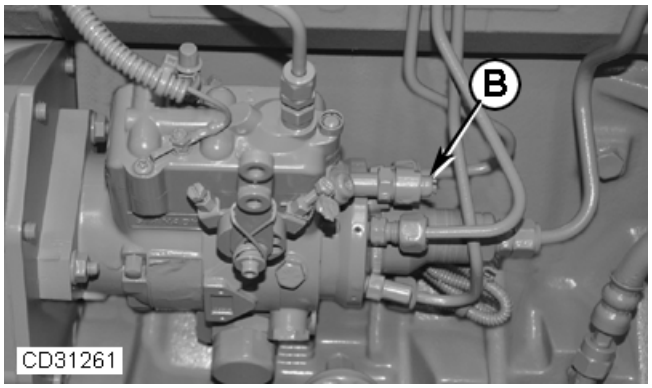
CD03523,00002C5 -19-23DEC10-1/1

Adjust Speed Droop Governor (3029 Engines)

1. Warm engine to normal operating temperature.
2. Run engine at fast idle.
3. Apply full load.
4. If specified power cannot be obtained, turn screw (B) to adjust droop until the requested power is reached.

NOTE: If surging exits upon removing the load, turn screw (B) clockwise to eliminate.

B—Speed Droop Governor Adjusting Screw



CD31261 —UN—10DEC10

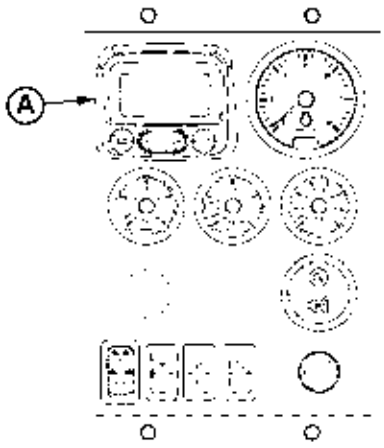
Speed Droop Governor Adjusting Screw

CD03523,00002C6 -19-23DEC10-1/1

Check Engine Speed (4045, 6068, and 6090 Engines)

If equipped with a tachometer (A) on the instrument panel, observe tachometer reading to verify engine speeds. Refer to Specifications Section later in this manual. If engine speed adjustment is required, see your authorized servicing dealer or engine distributor.

A—Tachometer



RG13728 —UN—11NOV04

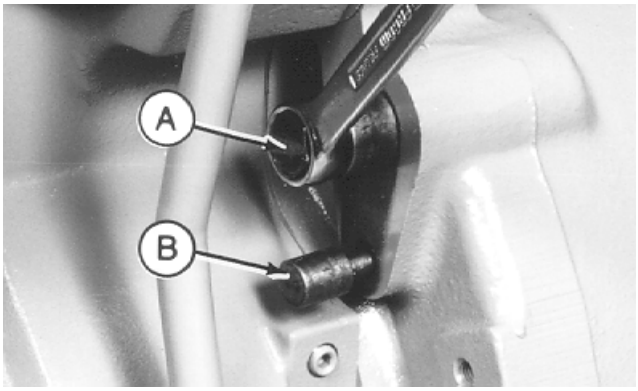
Using Tachometer to Check Engine Speeds

CD03523,00002C7 -19-23DEC10-1/1

Check and Adjust Engine Valve Clearance (3029 Engines)

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No. 1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDE81-4 (B) into flywheel bore.



CD30544 —UN—19MAY98

Lock Engine at Top Dead Center

A—Flywheel Turning Tool **B—Timing Pin**

CD03523,00002C8 -19-23DEC10-1/2

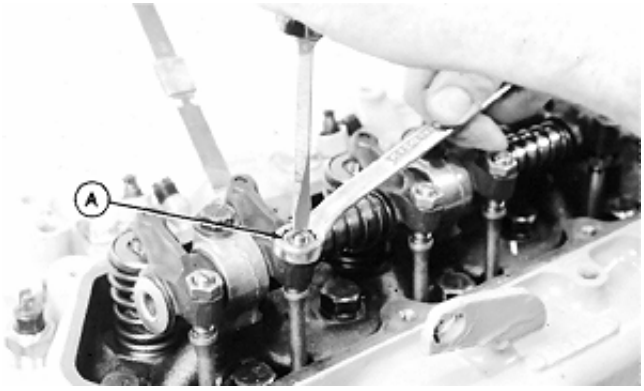
3. Check and adjust valve clearance to specifications according to the following procedure:

NOTE: Firing order is 1-2-3

   a. Lock No. 1 piston at TDC compression stroke (D).
   b. Adjust valve clearance on No. 1 and 2 exhaust valves and No. 1 and 3 intake valves.
   c. Rotate flywheel 360°. Lock No. 1 piston at TDC exhaust stroke (E).
   d. Adjust valve clearance on No. 3 exhaust valve and No. 2 intake valve.

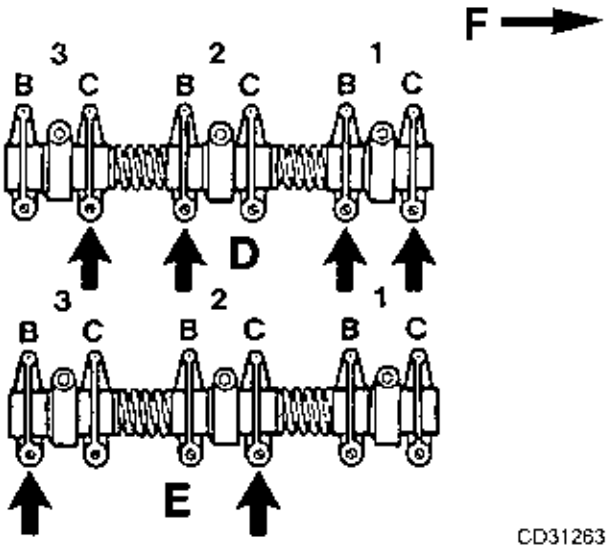
Specification	
Valve Clearance (Engine Cold)—Intake	0.35 mm (0.014 in.)
Exhaust	0.45 mm (0.018 in.)

4. If valves need adjusting, loosen the locknut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten locknut (A) to 27 N·m (20 lb.-ft.). Recheck clearance after tightening locknut. Readjust clearance as necessary.
5. Reinstall rocker arm cover and crankcase vent tube.



RG6307 —UN—03AUG92

Adjust Valve Clearance



CD31263 —UN—16DEC10

Valve Clearance Adjustment on 3029 Engines

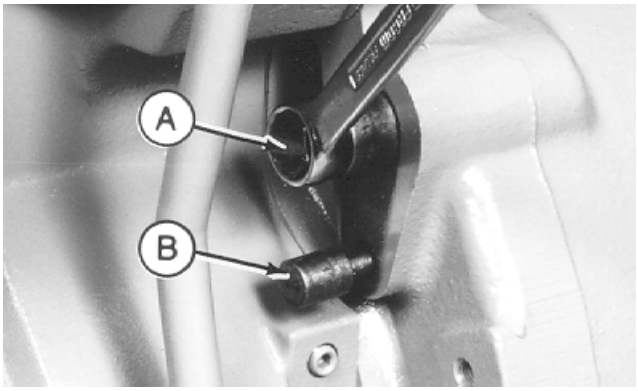
A—Adjusting Locknut
B—Exhaust Valve
C—Intake Valve
D—No. 1 Piston at TDC Compression Stroke
E—No. 1 Piston at TDC Exhaust Stroke
F—Front of Engine

CD03523,00002C8 -19-23DEC10-2/2

Check and Adjust Engine Valve Clearance (4045 and 6068 Engines)

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No. 1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDG1571 (B) into flywheel bore.



CD30544 —UN—19MAY98

Lock Engine at Top Dead Center

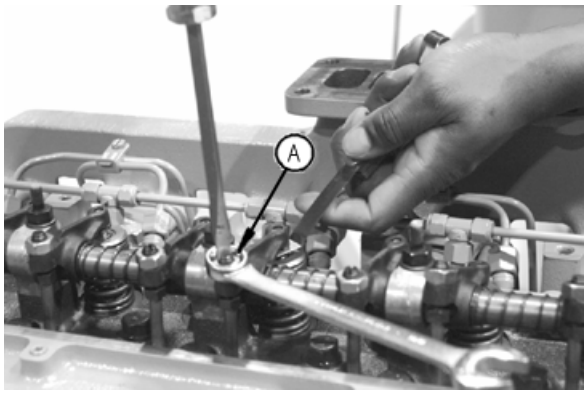
A—Flywheel Turning Tool **B—Timing Pin**

CD03523,00002C9 -19-23DEC10-1/4

3. Check and adjust valve clearance to specifications according to the following procedure:

Specification	
Valve Clearance (Engine Cold)—Intake	0.35 mm (0.014 in.)
Exhaust	0.45 mm (0.018 in.)

4. If valves need adjusting, loosen the locknut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten locknut (A) to 27 N·m (20 lb.-ft.). Recheck clearance after tightening locknut. Readjust clearance as necessary.
5. Reinstall rocker arm cover and crankcase vent tube.



RG7409 —UN—06AUG96

Adjust Valve Clearance

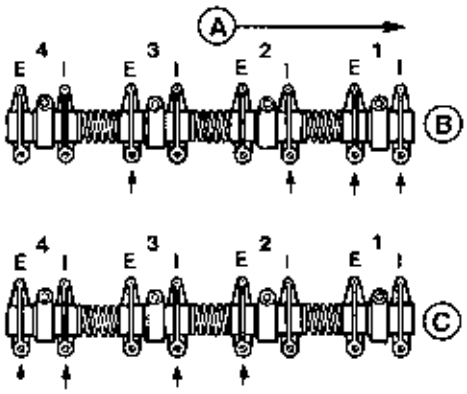
A—Locknut

CD03523,00002C9 -19-23DEC10-2/4

4045 Engine:

NOTE: Firing order is 1-3-4-2.

1. Lock No. 1 piston at TDC compression stroke (B).
2. Adjust valve clearance on No. 1 and 3 exhaust valves and No. 1 and 2 intake valves.
3. Rotate flywheel 360°. Lock No. 4 piston at TDC compression stroke (C).
4. Adjust valve clearance on No. 2 and 4 exhaust valves and No. 3 and 4 intake valves.



RG4776 —UN—31OCT97

Valve Clearance Adjustment on 4045 Engines

A—Front of Engine
B—No. 1 Piston at TDC Compression Stroke
C—No. 4 Piston at TDC Compression Stroke
E—Exhaust Valve
I— Intake Valve

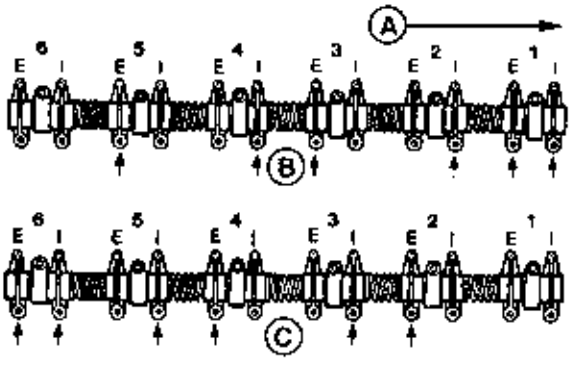
Continued on next page

CD03523,00002C9 -19-23DEC10-3/4

6068 Engine:

NOTE: Firing order is 1-5-3-6-2-4.

1. Lock No. 1 piston at TDC compression stroke (B).
2. Adjust valve clearance on No. 1, 3, and 5 exhaust valves and No. 1, 2, and 4 intake valves.
3. Rotate flywheel 360°. Lock No. 6 piston at TDC compression stroke (C).
4. Adjust valve clearance on No. 2, 4, and 6 exhaust valves and No. 3, 5, and 6 intake valves.



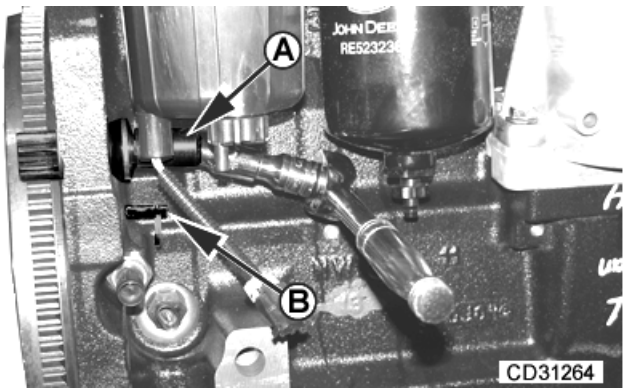
RG4777 —UN—31OCT97

Valve Clearance Adjustment on 6068 Engines

A—Front of Engine
B—No. 1 Piston at TDC Compression Stroke
C—No. 6 Piston at TDC Compression Stroke
E—Exhaust Valve
I— Intake Valve

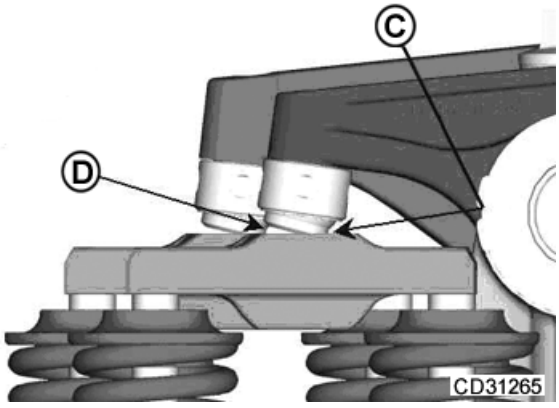
CD03523,00002C9 -19-23DEC10-4/4

Check and Adjust Engine Valve Clearance (6090 Engines)



CD31264 —UN—16DEC10

Lock Engine at Top Dead Center



CD31265 —UN—16DEC10

Valve Clearance Setting Procedure

A—Flywheel Turning Tool **B—Timing Pin** **C—Rocker Arm Foot** **D—Feeler Gauge Access**

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No. 1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDG1571 (B) into flywheel bore.

NOTE: To assist in adjusting valve clearance, push the rocker arm foot (C) forward for easier feeler gauge access (D).

Continued on next page

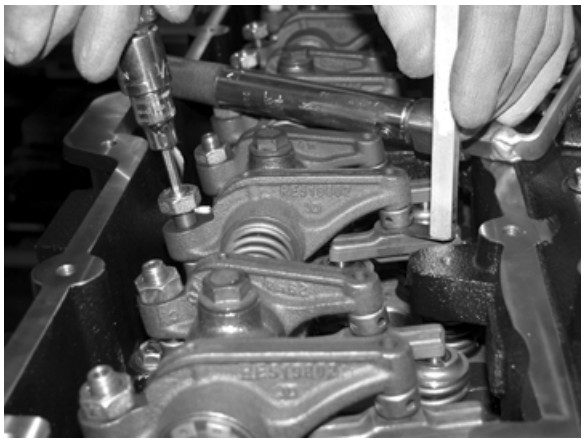
CD03523,00002CA -19-23DEC10-1/3

3. With engine locked at ”TDC” of No. 1 piston’s compression stroke, use a bent feeler gauge to check valve clearance on Nos. 1, 3, and 5 exhaust valves and Nos. 1, 2, and 4 intake valves. If out of specification, loosen lock nut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten lock nut to specifications.

Specification	
Intake Valve Clearance (Rocker Arm-to-Valve Tip With Engine Cold)—Clearance	0.18 mm (0.007 in.)
Exhaust Valve Clearance (Rocker Arm-to-Valve Tip With Engine Cold)—Clearance	0.64 mm (0.025 in.)
Valve Adjusting Screw Lock Nut—Torque	27 N•m (20 lb.-ft.)

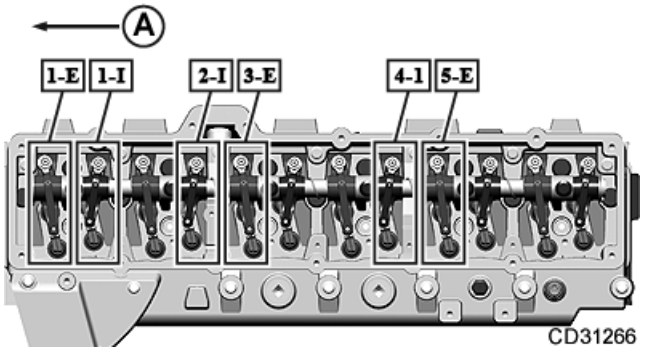
Recheck clearance again after tightening lock nut. Readjust clearance as necessary.

A—Front of Engine



RG13946 —UN—04FEB05

Checking Valve Clearance Using Bent Feeler Gauge



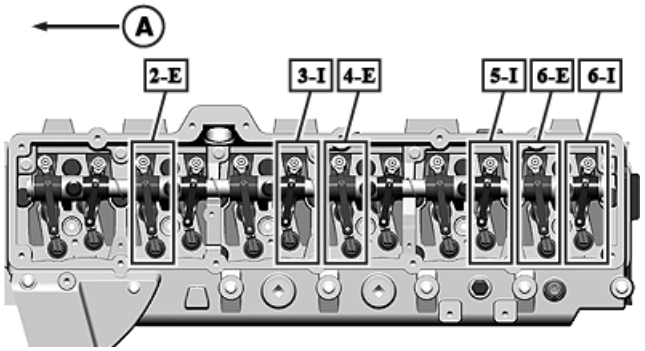
CD31266 —UN—16DEC10

Valve Adjusting Sequence - No. 1 Cylinder at TDC

CD03523,00002CA -19-23DEC10-2/3

4. Remove timing pin and rotate flywheel 360°, then reinstall timing pin. No. 6 piston is now at ”TDC” of its compression stroke. Rocker arms for No. 6 piston should be loose.
5. Check and adjust valve clearance to the same specifications on Nos. 2, 4, and 6 exhaust and Nos. 3, 5, and 6 intake valves.

A— Front of Engine



RG13839 —UN—04APR08

Valve Adjusting Sequence - No. 6 Cylinder at TDC

CD03523,00002CA -19-23DEC10-3/3

Drain and Flush Cooling System

NOTE: Drain and flush cooling system every 3000 hours/3 years when John Deere COOL-GARD coolant is used. Otherwise every 2000 hours/2 years.

TS281 —UN—23AUG88

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

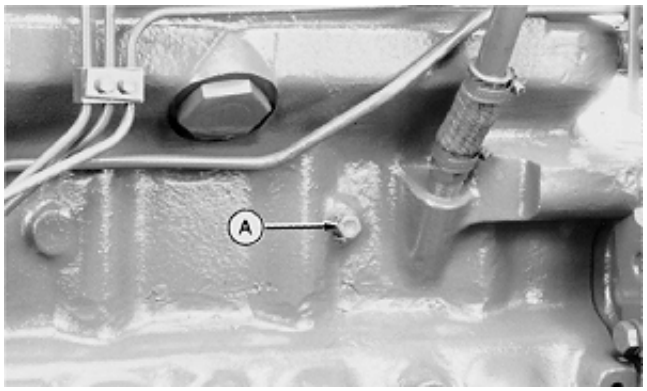
1. Slowly open the radiator cap.
2. Drain engine coolant according to following procedures:

CD03523,00002CB -19-23DEC10-1/6

a. **3029 Engines**

Remove engine block drain plug (A).

A—Engine Block Drain Plug



RG4894 —UN—14DEC88

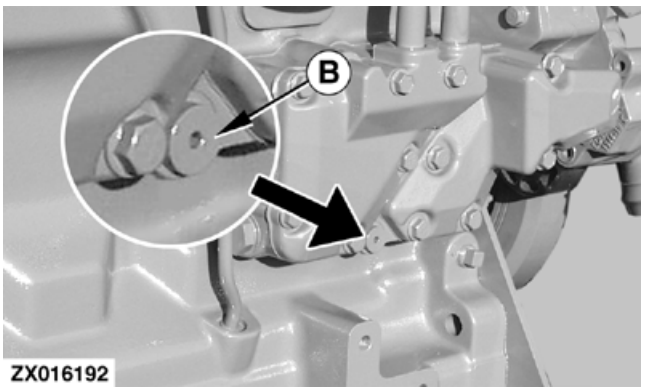
Engine Block Drain Plug

CD03523,00002CB -19-23DEC10-2/6

b. **4045 or 6068 Engines**

Remove oil cooler housing drain plug (B).

B—Oil Cooler Housing Drain Plug



ZX016192 —UN—11JAN99

Oil Cooler Housing Drain Plug

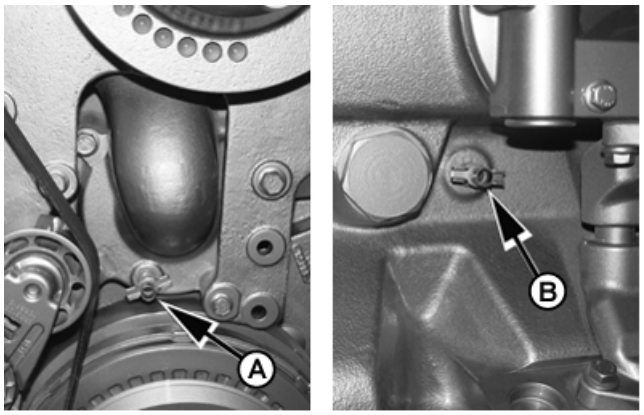
Continued on next page

CD03523,00002CB -19-23DEC10-3/6

c. **6090 Engines**

Open coolant pump drain valve (A) and engine block drain valve (B) on left side of engine. Drain all coolant from engine block.

A—Pump Drain Valve **B—Block Drain Valve**



RG13858 —UN—17JAN05

Cooling System Drain Valves

CD03523,00002CB -19-23DEC10-4/6

3. Open radiator drain valve (C). Drain all coolant from radiator.
4. Close all drain orifices after coolant has drained.
5. Fill the cooling system with clean water. Run engine until water passes through the thermostat to stir up possible rust or sediment.
6. Stop engine and immediately drain the water from system before rust and sediment settle.
7. After draining water, close all drain orifices and fill the cooling system with cleaning product such as PMCC2610 or PMCC2638 Cooling System Cleaners available from your John Deere Dealer. Follow manufacturer's directions on label.
8. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run engine until water passes through the thermostat, then drain out flushing water.
9. Check cooling system hoses for proper condition. Replace as necessary.
10. Close all drain orifices and fill the cooling system with specified coolant (see Diesel Engine Coolant).

CD30765 —UN—27AUG99

Radiator Drain Valve

C—Radiator Drain Valve

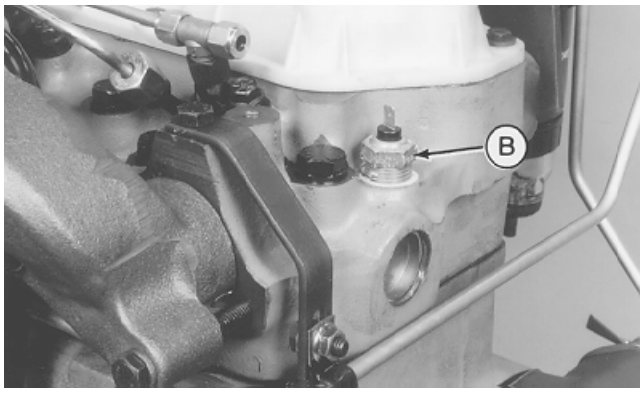
Cooling system capacity	
Engine Model	Cooling system capacity
3029 Engines	11 L (12 qt.)
4045 Engines	20 L (21.5 qt.)
6068 Engines	27 L (29 qt.)
6090 Engines	36 L (38.5 qt.)

Continued on next page

CD03523,00002CB -19-23DEC10-5/6

11. When refilling cooling system, loosen temperature sensor (B) or plug at the rear of cylinder head to allow air to escape (except for 6090 engines).
12. Run engine until it reaches operating temperature then check coolant level and entire cooling system for leaks.

B—Coolant Temperature Sensor



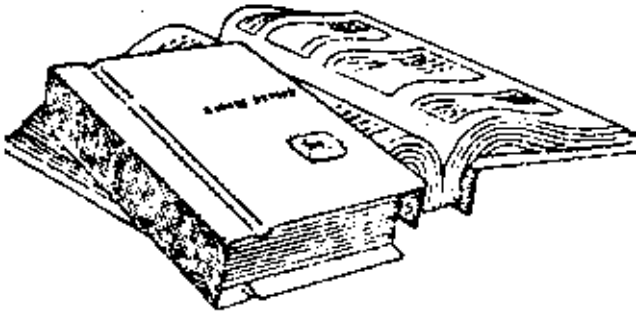
Coolant Temperature Sensor

CD03523,00002CB -19-23DEC10-6/6

Additional Service Information

This manual does not allow a complete repair of your engine. If you want more detailed service information, the following publications are available from your regular parts channel.

- PC10598 — Parts Catalog for 4045HFU82 Engines
- PC10600 — Parts Catalog for 6068HFU82 Engines
- PC10602 — Parts Catalog for 3029TFU80 Engines
- PC10604 — Parts Catalog for 6090HFU84 Engines
- CTM104 — Component Technical Manual for 4045 and 6068 base engines (English)
- CTM125 — Component Technical Manual for 3029 engines (English)
- CTM385 — Component Technical Manual for 6090 HPCR fuel system engines (English)
- CTM400 — Component Technical Manual for 6090 base engines (English)
- CTM502 — Component Technical Manual for HPCR Fuel System on 4045 and 6068 with 2-Valve Head Engines (English)



RG4624 —UN—15DEC88

- CTM67 — Component Technical Manual for OEM Engine accessories (English only)

CD03523,00002CC -19-20DEC10-1/1

Do Not Modify Fuel System

CAUTION: Do not open high-pressure fuel system.

High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair of fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system.

Only technicians familiar with this type of system can perform repairs. See your John Deere dealer.

IMPORTANT: Never steam clean or pour cold water on an injection pump while it is still warm. To do so may cause seizure of pump parts.

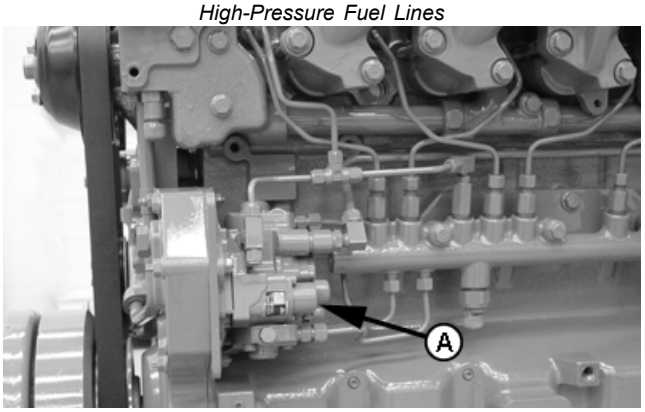
Modification or alteration of injection pump or high-pressure fuel pump (A), injection timing, or fuel injectors in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

In addition, tampering with fuel system which alters emission-related equipment on engines may result in fines or other penalties, per EPA regulations or other local emission laws.

Do not attempt to service injection pump or fuel injectors yourself. Special training and special tools are required. (See your authorized servicing dealer or engine distributor.)

TS1343 —UN—18MAR92

High-Pressure Fuel Lines



RG13735 —UN—11NOV04

Fuel System

A—High-Pressure Fuel Pump

CD03523,00002CD -19-20DEC10-1/1

Welding Near Electronic Control Units

IMPORTANT: Do not jump-start engines with arc welding equipment. Currents and voltages are too high and may cause permanent damage.

1. Disconnect the negative (-) battery cable(s).
2. Disconnect the positive (+) battery cable(s).
3. Connect the positive and negative cables together. Do not attach to vehicle frame.
4. Clear or move any wiring harness sections away from welding area.
5. Connect welder ground close to welding point and away from control units.

TS953 —UN—15MAY90

6. After welding, reverse Steps 1—5.

DX,WW,ECU02 -19-14AUG09-1/1

Keep Electronic Control Unit Connectors Clean

IMPORTANT: Do not open control unit and do not clean with a high-pressure spray. Moisture, dirt, and other contaminants may cause permanent damage.

1. Keep terminals clean and free of foreign debris. Moisture, dirt, and other contaminants may cause the terminals to erode over time and not make a good electrical connection.
2. If a connector is not in use, put on the proper dust cap or an appropriate seal to protect it from foreign debris and moisture.
3. Control units are not repairable.
4. Since control units are the components LEAST likely to fail, isolate failure before replacing by completing a diagnostic procedure. (See your John Deere dealer.)

RG16946 —UN—31MAR09

5. The wiring harness terminals and connectors for electronic control units are repairable.

DX,WW,ECU04 -19-11JUN09-1/1

Clean or Replace Air Filter (One-Piece)

Clean air filter when restriction indicator (A) is red. Air filter can be cleaned up to six times. Thereafter, or at least once a year, it must be replaced.

Proceed as follows:

1. Thoroughly clean all dirt around air filter area.
2. Loosen clamp (B) then remove air filter.

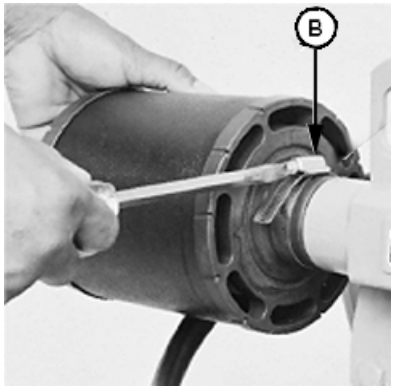
IMPORTANT: Never reinstall an air filter which shows evidence of bad condition (punched, dented etc.) allowing no filtered air to enter the engine.

3. Clean air filter with compressed air working from ”clean” to ”dirty” side.

NOTE: Compressed air pressure must not exceed 600 kPa (6 bar; 88 psi).

4. Mark air filter to keep track of each cleaning operation.
5. Fully depress air restriction indicator reset button and release to reset indicator.
6. Check air system entirely for proper condition (see Check Air Intake System).

CD30766 —UN—06SEP99



RG9912 —UN—25FEB99

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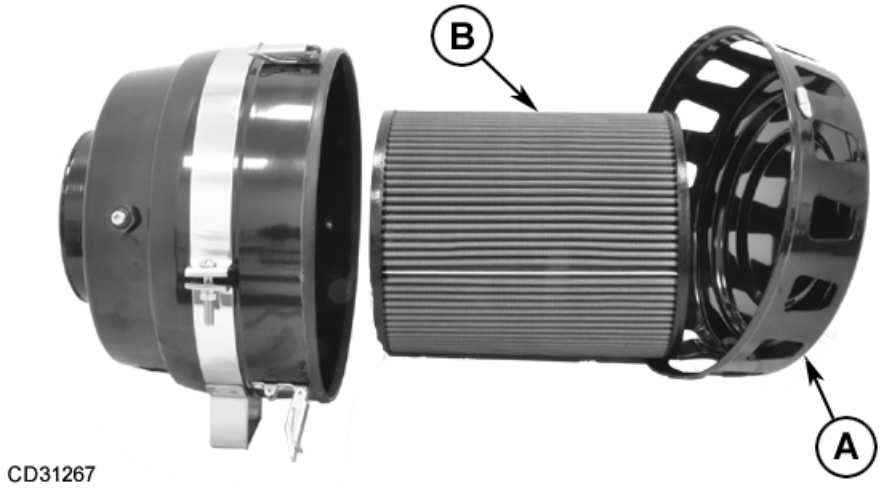
Clean or Replace Air Filter Element



CD31267 —UN—20DEC10

Replace Air Filter Element (6090 Engine Shown)

A—Air Filter Cover **B—Air Filter Element**

NOTE: The procedure for replacing air filter element can vary depending on air filter configuration.

Clean air filter element when restriction indicator is red. Air filter element can be cleaned up to six times. Thereafter, or at least once a year, it must be replaced.

Proceed as follows:

1. Thoroughly clean all dirt around air filter area.
2. Unlatch and remove air filter cover (A).
3. Remove air filter element (B) from canister.
4. Clean all dirt from inside canister.

IMPORTANT: Do not reinstall an air filter element which shows evidence of bad condition (punched, dented etc.) allowing no filtered air to enter the engine.

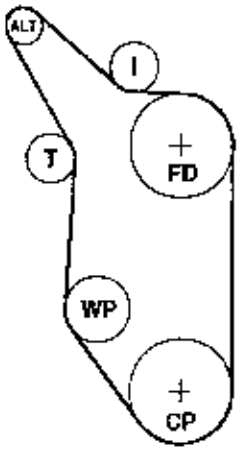
5. Clean air filter element with compressed air working from ”clean” to ”dirty” side.

NOTE: Compressed air pressure must not exceed 600 kPa (6 bar; 88 psi).

6. Mark air filter to keep track of each cleaning operation.
7. Fully depress air restriction indicator reset button and release to reset indicator.
8. Check air system entirely for proper condition (see Check Air Intake System).

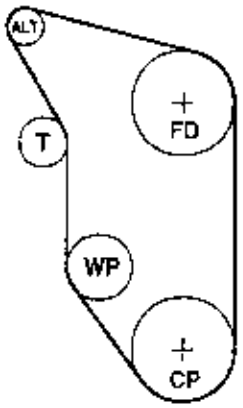
CD03523,00002CE -19-20DEC10-1/1

Replace Fan/Alternator Poly-V Belt (4045, 6068, and 6090 Engines)



CD30769 —UN—01SEP99

Fan/Alternator Belt Installation on 4045 Engines



CD30770 —UN—01SEP99

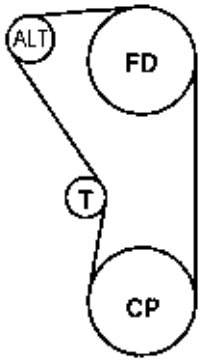
Fan/Alternator Belt Installation on 6068 Engines

NOTE: With the belt removed, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere Dealer or Distributor.

Refer to Check Belt in Section 35 to determine if belt needs to be replaced.

1. Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.
2. On engines with automatic belt tensioner, release tension on belt using a breaker bar and socket on tension arm.

   On engines with manual tensioner, loosen cap screws holding the alternator.
3. Remove poly-V belt from pulleys and discard belt.
4. Install new belt, making sure belt is correctly seated in all pulley grooves. Refer to belt routing shown for your application.
5. Apply tension to belt (See Check Belt in Section 35).



CD31268

CD31268 —UN—21DEC10

Fan/Alternator Belt Installation on 6090 Engines

ALT— Alternator
CP—Crank Pulley
FD—Fan Drive
I— Idler Pulley
T—Tensioner
WP—Water Pump

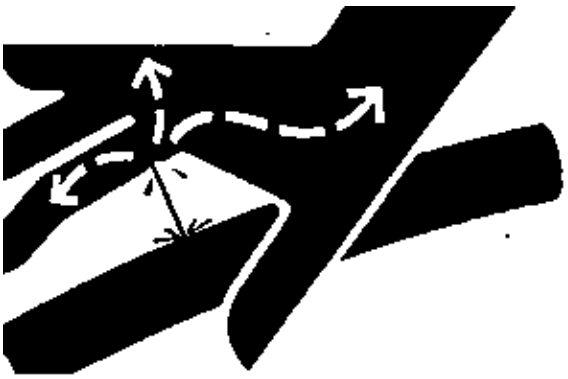
6. Start engine and check belt alignment.

CD03523,00002D0 -19-20DEC10-1/1

Bleed the Fuel System

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

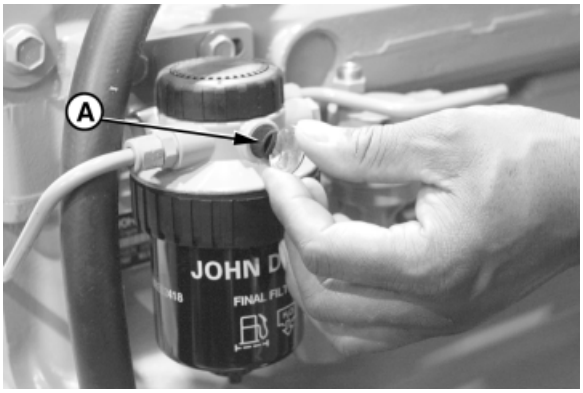


X9811 —UN—23AUG88

NOTE: 3029 engines have a single fuel filter while 4045, 6068, and 6090 engines have two fuel filters (primary and final). Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system. On dual fuel filter system, bleed air only from final filter.

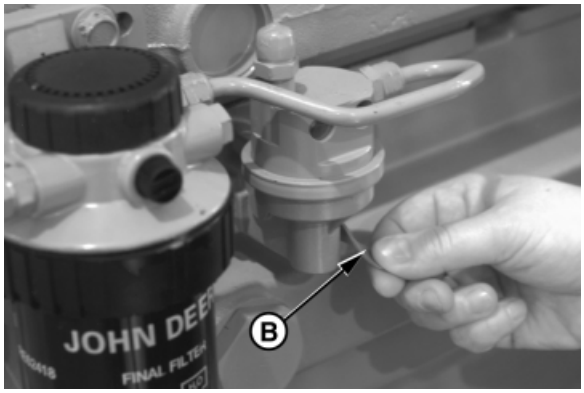
CD03523,00002D1 -19-21DEC10-1/6

3029 Engines



RG7947 —UN—13NOV97

Fuel Filter Bleed Screw



RG8013A —UN—15JAN99

Fuel Pump Primer Lever

A—Air Bleed Screw **B—Fuel Pump Primer Lever**

1. Loosen the air bleed screw (A) two full turns.
2. Operate fuel pump primer lever (B) until fuel flow is free from air bubbles.
3. Tighten bleed screw securely, continue operating hand primer until pumping action is not felt.
4. Start engine and check for leaks.

   If engine does not start, it will be necessary to bleed air from fuel system at fuel injection pump or injection nozzles as explained next.

Continued on next page

CD03523,00002D1 -19-21DEC10-2/6

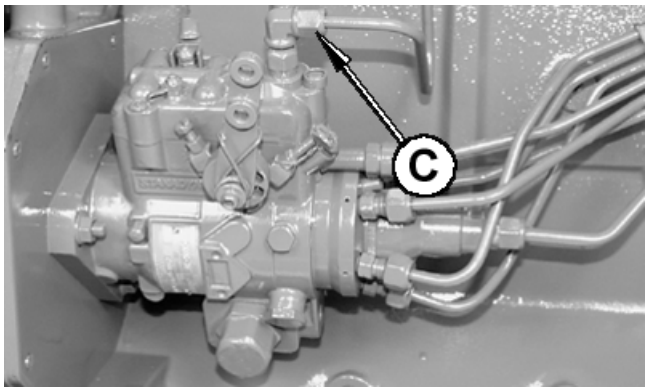
5. **At Fuel Injection Pump:**

   a. Slightly loosen fuel return line connection (C) at fuel injection pump.

   b. Operate fuel pump primer lever until fuel, without air bubbles, flows from fuel return line connection.

   c. Securely tighten return line connection.

C—Fuel Return Line Connection



CD30771 —UN—24SEP99

Mechanical Injection Pump Return Line

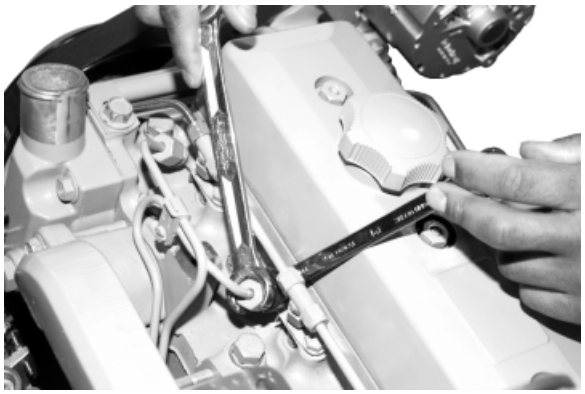
CD03523,00002D1 -19-21DEC10-3/6

6. **At Fuel Injection Nozzles:**

   a. Using two open-end wrenches, loosen fuel line connection at injection nozzle.

   b. Crank engine over with starting motor, (but do not start engine), until fuel free from bubbles flows out of loosened connection. Retighten connection to 27 N·m (20 lb.-ft.).

   c. Repeat procedure for remaining injection nozzles (if necessary) until all air has been removed from fuel system.
   If engine still will not start, see your authorized servicing dealer or engine distributor.



RG7725 —UN—08JAN97

Bleed Fuel System at Fuel Injection Nozzles

Continued on next page

CD03523,00002D1 -19-21DEC10-4/6

4045 and 6068 Engines

TS1343 —UN—18MAR92

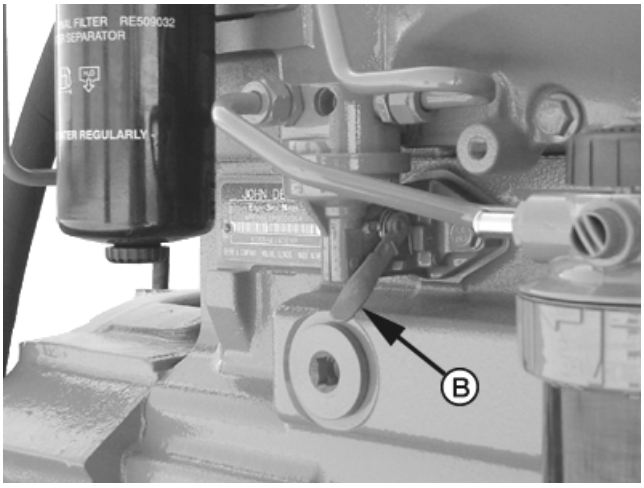
RG12220 —UN—24MAY02

Final Fuel Filter Bleed Screw

⚠ CAUTION: High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect fuel lines between the high pressure fuel pump and nozzles. Only bleed the fuel system at the fuel filter bleed screw (A).

1. Loosen the air bleed screw (A) two full turns on final filter base only.
2. Operate fuel supply pump primer lever (B) until fuel flow is free from air bubbles.
3. Tighten bleed screw securely. Continue operating primer until pumping action is not felt.
4. Start engine and check for leaks.

   If engine will not start, repeat steps 1-4.



RG12221 —UN—24MAY02

Fuel Pump Primer Lever

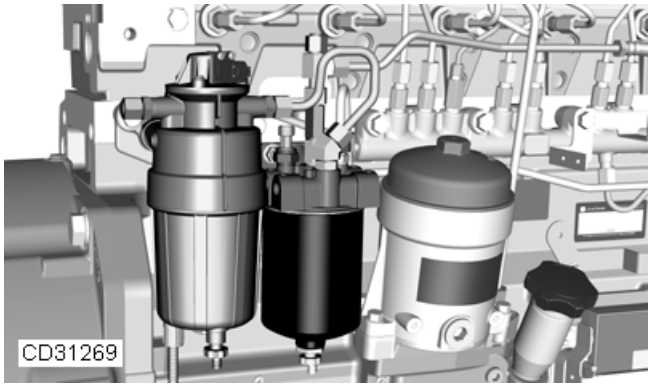
A—Air Bleed Screw **B—Fuel Pump Primer Lever**

CD03523,00002D1 -19-21DEC10-5/6

6090 Engines

NOTE: The fuel system is self-priming and self-bleeding, and does not require a bleeding procedure by the operator.

If engine will not start after filter change, turn ignition key ON for 60 seconds to prime the fuel system. It may be necessary to turn the key OFF and ON again to reprime the system before starting.



CD31269 —UN—21DEC10

CD03523,00002D1 -19-21DEC10-6/6

General Troubleshooting Information

Troubleshooting electronically controlled engine problems can be difficult. The first thing to do is to identify the type of problem which can be mechanical or electrical.

An engine wiring layout is provided in this section to identify electrical components (engine controller, sensors, connectors etc.).

Later in this section is a list of possible engine problems and diagnostic trouble codes that may be encountered accompanied by possible causes and corrections. This troubleshooting information is of a general nature. See also the generator documentation for a complete information of your application.

A reliable program for troubleshooting engine problems should include the following basic diagnostic thought process:

- Know the engine and all related systems.
- Study the problem thoroughly.
- Relate the symptoms to your knowledge of engine and systems.
- Diagnose the problem starting with the easiest things first.
- Double-check before beginning the disassembly.
- Determine cause and make a thorough repair.
- After making repairs, operate the engine under normal conditions to verify that the problem and cause was corrected.

NOTE: 4045, 6068, and 6090 engines have electronic control systems which may generate diagnostic trouble codes to signal problems (see Displaying of Diagnostic Trouble Codes).

1. *If diagnostic trouble codes are present, perform the suggested corrective actions.*
2. *If this does not correct the engine problem, contact your servicing dealer.*
3. *If engine has problems but no diagnostic trouble codes are displayed, refer to Engine Troubleshooting for problems and solutions.*

CD03523,00002D2 -19-22DEC10-1/1

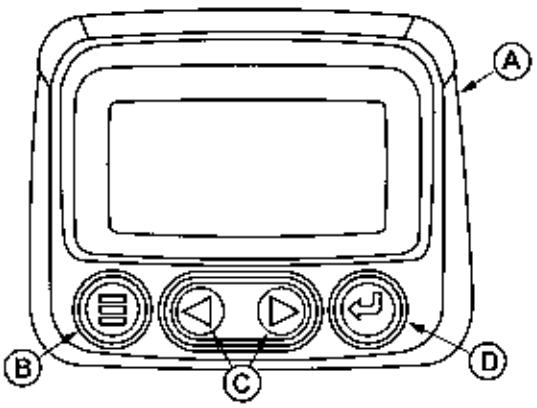
Using Diagnostic Gauge for Retrieving Diagnostic Trouble Codes (DTC's)

NOTE: The method below applies on applications having the optional diagnostic gauge shown (refer to the generator documentation for more information).

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly. See Engine Troubleshooting.

NOTE: Diagnostic gauge (A) has a menu key (B) to access various engine functions, two arrow keys (C) to scroll through the engine parameter list and view the menu list, and an enter key (D) to select highlighted items.

2. Read and record DTC(s) displayed on LCD of diagnostic gauge (A). For procedure to access diagnostic trouble codes, refer to Using Diagnostic Gauge to Access Engine Information, earlier in this manual.
3. Go to the Listing of Diagnostic Trouble Codes (DTC) to interpret the DTC(s) present.
4. Contact your nearest engine distributor or servicing dealer with a list of DTC(s) so that necessary repairs can be made.



RG13740 —UN—11NOV04

Diagnostic Trouble Code Display on Instrument Panel

A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Enter Key

CD03523,00002D3 -19-22DEC10-1/1

Displaying Of Diagnostic Trouble Codes (DTCs)

There are several different methods for displaying both stored and active DTCs from the ECU via a fault lamp or a diagnostic gauge on the electronic instrument panel.

2-DIGIT CODES

Some engines display Service Codes or DTCs as 2-digit codes read from a fault lamp which gives blink codes.

SPN/FMI CODES

Stored and active diagnostic trouble codes are output on the diagnostic gauge on the Deere electronic instrument panel according to the J1939 standard as a two-part code as shown on the tables on the following pages.

The first part is a six-digit Suspect Parameter Number (SPN) followed by a two-digit Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example SPN 000110 indicates a failure in the engine coolant temperature circuit.

The FMI identifies the type of failure that has occurred; for example FMI 03 indicates value above normal. Combining SPN 000110 with FMI 03 yields engine coolant temperature input voltage too high, or the equivalent of 2-digit fault code 18.

If diagnosing an application that shows DTCs as SPNs and FMIs, using the following list, determine the equivalent 2-digit code and have your dealer use the diagnostic procedure in the component technical manual for that 2-digit code.

Always contact your servicing dealer for help in correcting diagnostic trouble codes which are displayed for your engine.

CD03523,0000190 -19-02FEB07-1/1

Using Blink Code Method for Retrieving Diagnostic Trouble Codes (DTC's)

NOTE: The method below applies to applications having a fault lamp on instrument panel (refer to the generator documentation for more information).

The Electronic Control Unit (ECU) has the ability to display DTCs using blinking sequence of the fault lamp.

NOTE: The ECU blinks the codes in 2-digit codes only. See Listing of Diagnostic Trouble Codes (DTCs).

1. Press Override Shutdown Switch while turning the ignition switch "ON".
2. The Fault Lamp will begin to flash a code number. For example, flash three times...short pause...flash two times...long pause. This example is code 32.
3. The ECU begins the flashing sequence by flashing a code 32, this indicates the start of blinking active codes. If there are any active DTCs, the ECU will flash its 2–digit number. If there is more than one active DTC, the ECU will flash each code in numerical order. If there are no active DTCs, the Fault Lamp will flash a code 88.
4. Following the active codes, the Fault Lamp will flash a code 33. This indicates the start of blinking stored codes. If there are any stored DTCs, the Fault Lamp will flash its 2–digit number. If there is more than one stored DTC, the ECU will flash each code in numerical order. If there are no stored DTCs, the Fault Lamp will flash a code 88.
5. Once completed, this sequence will be repeated.
6. When completed, turn ignition "OFF".

As an example, if an engine had an active DTC 18 and stored DTC 53, the flashing sequence would be: flash three times...short pause...flash two times...long pause...flash one time...short pause...flash eight times...long pause...flash three times...short pause...flash three times...long pause...flash five times...short pause...flash three times.

CD03523,00002D9 -19-22DEC10-1/1

Intermittent Fault Diagnostics (With Electronic Controls)

Intermittent faults are problems that periodically ”go away”. A problem such as a terminal that intermittently doesn’t make contact can cause an intermittent fault. Other intermittent faults may be set only under certain operating conditions such as heavy load, extended idle, etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors, since a high percentage of intermittent problems originate here. Check for loose, dirty or disconnected connectors. Inspect the wiring routing, looking for possible shorts caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity, looking for wires that have been pulled out of connectors, poorly positioned terminals, damaged connectors and corroded or damaged splices and terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgement if component replacement is thought to be required.

NOTE: The engine control unit (ECU) is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

- If the problem is intermittent, try to reproduce the operating conditions that were present when the diagnostic trouble code (DTC) was set.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the diagnostic gauge to see if the fault resets.

Possible causes of intermittent faults:

- Faulty connection between sensor or actuator harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc., can cause faulty signals to be sent to the ECU.

NOTE: Refer also to generator documents for more information about connections and wirings.

CD03523,00002DA -19-22DEC10-1/1

Listing of Diagnostic Trouble Codes (DTCs)

NOTE: Not all of these codes are used on all OEM engine applications.

Diagnostic Trouble Codes

SPN	FMI	Description of Fault	Corrective Action
000028	03	Throttle #3 Signal Out of Range High	Check Sensor and Wiring
	04	Throttle #3 Signal Out of Range Low	Check Sensor and Wiring
000029	03	Throttle #2 Signal Out of Range High	Check Sensor and Wiring
	04	Throttle #2 Signal Out of Range Low	Check Sensor and Wiring
000084	31	Vehicle Speed Signal Unreliable	Contact Servicing Dealer
000091	03	Throttle #1 Signal Out of Range High	Check Switch and Wiring
	04	Throttle #1 Signal Out of Range Low	Check Switch and Wiring
	09	Throttle #1 Communication Signal Erratic	Check Sensor and Wiring
000094	03	Low Pressure Fuel Signal Out of Range High	Check Sensor and Wiring
	04	Low Pressure Fuel Signal Out of Range Low	Check Sensor and Wiring
	10	Low Pressure Fuel Rate of Change Abnormal	Contact Servicing Dealer
	13	Low Pressure Fuel Out of Calibration	Contact Servicing Dealer
	17	High Pressure Fuel System- Pressure Slightly Low	Contact Servicing Dealer
000097	00	Water in Fuel Continuously Detected	Contact Servicing Dealer
	03	Water-in-Fuel Signal Out of Range High	Check Sensor and Wiring
	04	Water-in-Fuel Signal Out of Range Low	Check Sensor and Wiring
	16	Water in Fuel Detected	Stop and Drain Water Separator
000100	01	Engine Oil Pressure Signal Extremely Low	Check Oil Level
	03	Engine Oil Pressure Signal Out of Range High	Check Sensor and Wiring
	04	Engine Oil Pressure Signal Out of Range Low	Check Sensor and Wiring
	18	Engine Oil Pressure Signal Moderately Low	Check Oil Level
000105	00	Intake Manifold Air Temperature Signal Extremely High	Check Air Cleaner, Aftercooler, or Room Temperature
	03	Intake Manifold Air Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Intake Manifold Air Temperature Signal Out of Range Low	Check Sensor and Wiring
	16	Intake Manifold Air Temperature Signal Moderately High	Check Air Cleaner, Aftercooler, or Room Temperature
000107	00	Air Filter Pressure Differential Extremely High	Check for plugged air filter
000110	00	Engine Coolant Temperature Signal Extremely High	Check Cooling System, Reduce Power
	03	Engine Coolant Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Engine Coolant Temperature Signal Out of Range Low	Check Sensor and Wiring
	15	Engine Coolant Temperature Signal Slightly High	Check Cooling System, Reduce Power
	16	Engine Coolant Temperature Signal Moderately High	Check Cooling System, Reduce Power
000111	01	Engine Coolant Level Low	Check Operator's Manual, "Adding Coolant"
000158	17	ECU Power Down Error (Internal ECU Problem)	Contact Servicing Dealer
000160	02	Axle Speed Signal Unreliable	Contact Servicing Dealer
000174	00	Fuel Temperature Signal Extremely High	Add Fuel or Switch Fuel Tanks
000174	03	Fuel Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Fuel Temperature Signal Out of Range Low	Check Sensor and Wiring
	16	Fuel Temperature Signal Moderately High	Add Fuel or Switch Fuel Tanks
000189	00	Engine Speed Derate Condition Exists	Check Diagnostic Trouble Codes or Contact Servicing Dealer
000190	00	Engine Speed Extremely High	Reduce Engine Speed
	16	Engine Speed Moderately High	Reduce Engine Speed
000611	03	Injector Shorted to Power	Check Wiring
	04	Injector Shorted to Ground	Check Wiring

Continued on next page

SPN	FMI	Description of Fault	Corrective Action
000620	03	Sensor Supply 2 Voltage High	Check Wiring
	04	Sensor Supply 2 Voltage Low	Check Wiring
000627	01	All Injector Currents Are Low	Check Battery Voltage and Wiring
000629	13	ECU Programming Error	Contact Service Dealer
000636	02	Engine Position Sensor Signal Unreliable	Check Sensor and Wiring
	08	Engine Position Sensor Signal Missing	Check Sensor and Wiring
	10	Engine Position Sensor Signal Rate of Change Abnormal	Check Sensor and Wiring
000637	02	Engine Timing Sensor Signal Unreliable	Check Sensor and Wiring
	07	Engine Timing and Position Sensors Out of Sync	Check Sensor and Wiring
	08	Engine Timing Sensor Signal Missing	Check Sensor and Wiring
	10	Engine Timing Signal Rate of Change Abnormal	Check Sensor and Wiring
000639	13	CAN Bus Error (Communication network problem)	Contact Servicing Dealer
000651	05	Injector Number 1 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 1 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 1 Not Responding	Injector Failed or Flow Limiter Closed
000652	05	Injector Number 2 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 2 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 2 Not Responding	Injector Failed or Flow Limiter Closed
000653	05	Injector Number 3 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 3 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 3 Not Responding	Injector Failed or Flow Limiter Closed
000654	05	Injector Number 4 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 4 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 4 Not Responding	Injector Failed or Flow Limiter Closed
000655	05	Injector Number 5 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 5 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 5 Not Responding	Injector Failed or Flow Limiter Closed
000656	05	Injector Number 6 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 6 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 6 Not Responding	Injector Failed or Flow Limiter Closed
000898	09	Vehicle Speed or Torque Message Unreliable	Contact Servicing Dealer
000970	31	External Shutdown Switch Activated	Not Engine Fault. Check Other Shutdown Devices
000971	31	External Fuel Derate Switch Active	Not Engine Fault. Check Other Shutdown Devices
001069	09	Tire Size Invalid	Contact Servicing Dealer
	31	Tire Size Error	Contact Servicing Dealer
001079	03	Sensor Supply 1 Voltage High	Check Wiring
	04	Sensor Supply 1 Voltage Low	Check Wiring
001080	03	Fuel Rail Pressure Sensor Supply Voltage High	Check Wiring
	04	Fuel Rail Pressure Sensor Supply Voltage Low	Check Wiring
001109	31	Engine Protection Shutdown Warning	Shut Down Engine, Check Diagnostic Trouble Codes
001110	31	Engine Protection Shutdown Active	Shut Down Engine, Check Diagnostic Trouble Codes
001347	03	High Pressure Fuel Pump Control Valve Signal Out of Range High	Contact Servicing Dealer
	05	High Pressure Fuel Pump Solenoid Number 1 Circuit Has High Resistance	Check Pump Wiring
	07	High Pressure Fuel Pump Not Able to Meet Required Rail Pressure	Check Fuel Filter and Lines
001568	02	Requested Torque Curve Signal Unreliable	Contact Servicing Dealer
001569	31	Engine in Derate Condition	Check Diagnostic Trouble Codes
002000	13	Security Violation	Contact Servicing Dealer

DTC's Listing in Ascending SPN/FMI Codes

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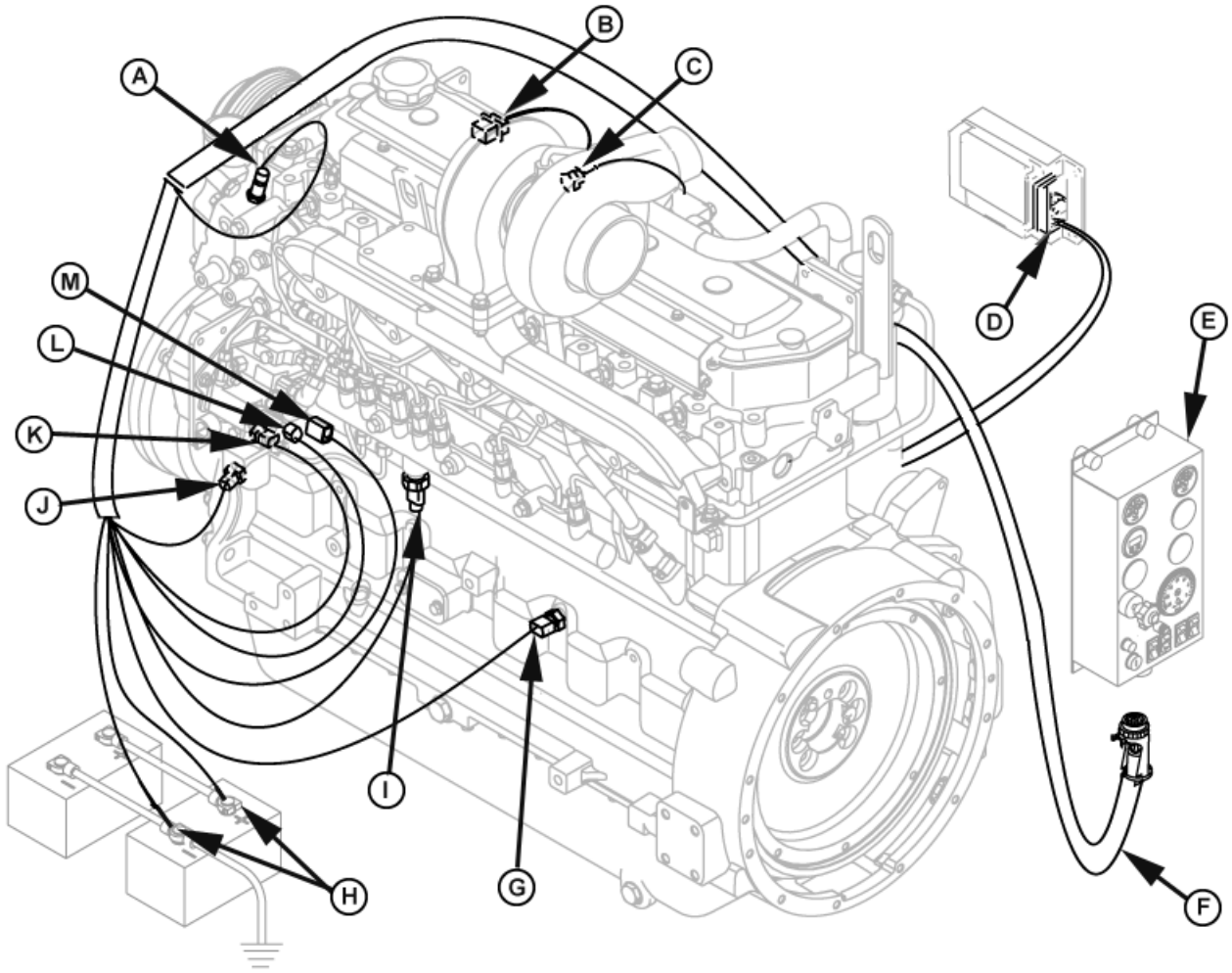
Engine Wiring Harness Layout (4045 and 6068 Engines)



6068HFU82 Engine Shown

A—Engine Coolant Temperature (ECT) Sensor
B—Electronic Injector Connector
C—Manifold Air Temperature (MAT) Sensor
D—ECU Connector
E—Optional Instrument Panel or Generator Instrument Panel
F—Engine Wiring Harness
G—Engine Oil Pressure Sensor Connector
H—Power and Ground Battery Connections
I— Fuel Rail Pressure Sensor
J— Crankshaft Position Sensor
K—Pump Position Sensor
L—Pump Control Valve Solenoid
M—Fuel Temperature Sensor

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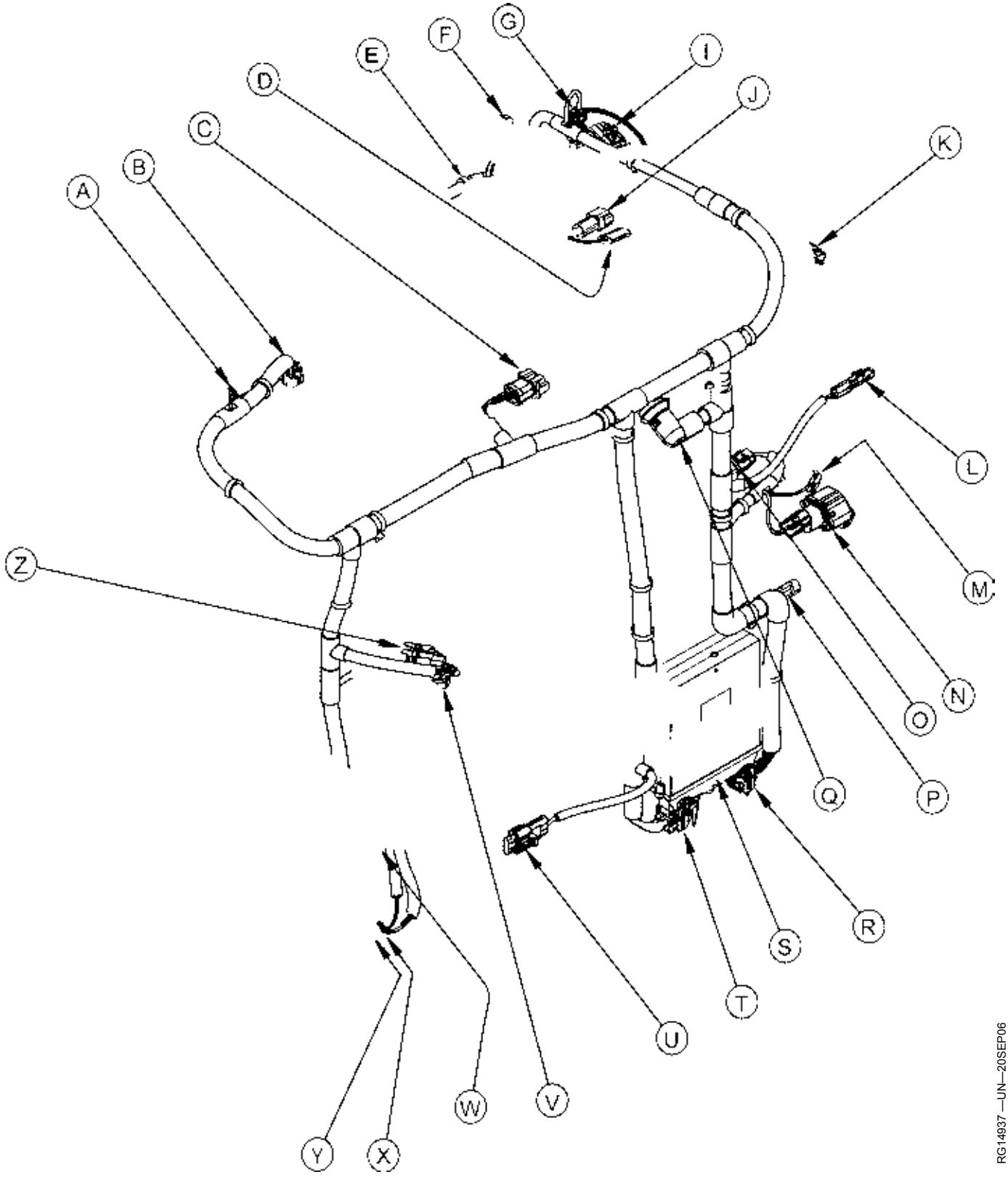
Engine Wiring Harness Layout (6090 Engines)



Electrical Wiring Harness Layout

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CD03523,00002D6 -19-22DEC10-1/2

A—Manifold Air Pressure (MAP) Sensor Connector
B—Exhaust Gas Recirculation (EGR) Mixed Air Temperature Sensor Connector
C—Turbocharger Sensor Jumper Connector
D—VGT Turbocharger Connector
E—Exhaust Gas Recirculation (EGR) Exhaust Temperature Sensor Connector
F—Exhaust Gas Recirculation (EGR) Valve Sensor Connector
G—Exhaust Pressure Sensor Connector
H—Exhaust Gas Recirculation (EGR) Fresh Air Sensor Connector
I— Air Heater Jumper Connection
J—VGT Turbocharger Connector
K—Coolant Temperature Sensor Connector
L—Alternator Excitation Connector
M—Fuel Temperature Sensor Connector
N—Fuel Pump Control Valve Connector
O—Fuel Rail Pressure Sensor Connector
P—Camshaft Sensor Connector
Q—Fuel Injector Connector
R—ECU Connector
S—ECU
T—ECU Connector
U—Auxiliary Power Connector
V—Fuel Pressure Sensor
W—Water-in-Fuel Sensor
X—Crankshaft Speed/Position Sensor
Y—Oil Pressure Sensor
Z—Fuel Transfer Pump Sensor

CD03523,00002D6 -19-22DEC10-2/2

Engine Troubleshooting

NOTE: Before troubleshooting 4045, 6068, or 6090 engine, first retrieve any diagnostic trouble codes on the diagnostic gauge display and perform the corrective actions. If any problems remain, use the following charts to solve engine problems.

Symptom	Problem	Solution
Engine cranks but will not start	Incorrect starting procedure.	Verify correct starting procedure.
	No fuel.	Check fuel in tank and manual shut-off valve.
	Exhaust restricted.	Check and correct exhaust restriction.
	Fuel filter plugged or full of water.	Replace fuel filter or drain water from filter.
	Injection pump not getting fuel or air in fuel system.	Check fuel flow at supply pump or bleed fuel system.
	Faulty injection pump or nozzles.	Consult authorized diesel repair station for repair or replacement.
Engine hard to start or will not start	Engine starting under load.	Remove load.
	Improper starting procedure.	Review starting procedure.
	No fuel.	Check fuel tank.
	Air in fuel line.	Bleed fuel line.
	Cold weather.	Use cold weather starting aids.
	Slow starter speed.	See ”Starter Cranks Slowly”.
	Crankcase oil too heavy.	Use oil of proper viscosity.
	Improper type of fuel.	Consult fuel supplier; use proper type fuel for operating conditions.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Clogged fuel filter.	Replace filter element.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection pump shut-off not reset.	Turn key switch to ”OFF” then to ”ON”.
Engine knocks	Low engine oil level.	Add oil to engine crankcase.
	Injection pump out of time.	See your authorized servicing dealer or engine distributor.
	Low coolant temperature.	Remove and check thermostat.

Continued on next page

Symptom	Problem	Solution
	Engine overheating.	See ”Engine Overheats”.
Engine runs irregularly or stalls frequently	Low coolant temperature.	Remove and check thermostat.
	Clogged fuel filter.	Replace fuel filter element.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
Below normal engine temperature	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check gauge, sender, and connections.
Lack of power	Engine overloaded.	Reduce load.
	Intake air restriction.	Service air cleaner.
	Clogged fuel filter.	Replace filter elements.
	Improper type of fuel.	Use proper fuel.
	Overheated engine.	See ”Engine Overheats”.
	Below normal engine temperature.	Remove and check thermostat.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection pump out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.
	Leaking exhaust manifold gasket.	See your authorized servicing dealer or engine distributor.
	Defective aneroid control line.	See your authorized servicing dealer or engine distributor.
	Restricted fuel hose.	Clean or replace fuel hose.
	Low fast idle speed.	See your authorized servicing dealer or engine distributor.
Low oil pressure	Low oil level.	Add oil.

Continued on next page

Symptom	Problem	Solution
	Improper type of oil.	Drain, fill crankcase with oil of proper viscosity and quality.
High oil consumption	Crankcase oil too light.	Use proper viscosity oil.
	Oil leaks.	Check for leaks in lines, gaskets, and drain plug.
	Restricted crankcase vent tube.	Clean vent tube.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
Engine emits white smoke	Improper type of fuel.	Use proper fuel.
	Low engine temperature.	Warm up engine to normal operating temperature.
	Defective thermostat.	Remove and check thermostat.
	Defective injection nozzles.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
Engine emits black or gray exhaust smoke	Improper type of fuel.	Use proper fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.
Engine overheats	Engine overloaded.	Reduce load.
	Low coolant level.	Fill radiator to proper level, check radiator and hoses for loose connections or leaks.
	Faulty radiator cap.	Have serviceman check.
	Stretched poly V-belt or defective belt tensioner.	Check automatic belt tensioner and check belts for stretching. Replace as required.

Continued on next page

Symptom	Problem	Solution
	Low engine oil level.	Check oil level. Add oil as required.
	Cooling system needs flushing.	Flush cooling system.
	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check water temperature with thermometer and replace, if necessary.
	Incorrect grade of fuel.	Use correct grade of fuel.
High fuel consumption	Improper type of fuel.	Use proper type of fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
	Low engine temperature.	Check thermostat.

CD03523,00002D7 -19-22DEC10-4/4

Electrical Troubleshooting

Symptom	Problem	Solution
Undercharged system	Excessive electrical load from added accessories.	Remove accessories or install higher output alternator.
	Excessive engine idling.	Increase engine rpm when heavy electrical load is used.
	Poor electrical connections on battery, ground strap, starter, or alternator.	Inspect and clean as necessary.
	Defective battery.	Test battery.
	Defective alternator.	Test charging system.
Battery uses too much water	Cracked battery case.	Check for moisture and replace as necessary.
	Defective battery.	Test battery.
	Battery charging rate too high.	Test charging system.
Batteries will not charge	Loose or corroded connections.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Stretched poly V-belt or defective belt tensioner.	Adjust belt tension or replace belts.
Starter will not crank	Engine under load.	Remove load.
	Loose or corroded connections.	Clean and tighten loose connections.
	Low battery output voltage.	See your authorized servicing dealer or engine distributor.
	Faulty start circuit relay.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.
Starter cranks slowly	Low battery output.	See your authorized servicing dealer or engine distributor.
	Crankcase oil too heavy.	Use proper viscosity oil.
	Loose or corroded connections.	Clean and tighten loose connections.
Entire electrical system	Faulty battery connection.	Clean and tighten connections.

Continued on next page

Symptom	Problem	Solution
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.

CD03523,00002D8 -19-22DEC10-2/2

Storage

Engine Storage Guidelines

1. John Deere engines can be stored outside for up to three (3) months with no long term preparation IF COVERED BY WATERPROOF COVERING.
2. John Deere engines can be stored in a standard overseas shipping container for up to three (3) months with no long term preparation.
3. John Deere engines can be stored inside, warehoused, for up to six (6) months with no long term preparation.
4. John Deere engines expected to be stored more than six (6) months MUST have long term storage preparation. See Prepare Engine for Long Term Storage.

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Prepare Engine for Long Term Storage

The following storage preparations are used for long term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

IMPORTANT: Any time your engine will not be used for over six (6) months, the following recommendations for storing it and removing it from storage will help to minimize corrosion and deterioration.

1. Change engine oil and replace filter. Used oil will not give adequate protection. See Change Oil and Filter.
2. Service air cleaner. See Clean or Replace Air Filter.
3. Draining and flushing of cooling system is not necessary if engine is to be stored only for several months. However, for extended storage periods of a year or longer, it is recommended that the cooling system is drained, flushed, and refilled. Refill with appropriate coolant. See Diesel Engine Coolant.
4. Fill the fuel tank.
5. Remove fan/alternator belt, if desired.
6. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
7. Clean the exterior of the engine with salt-free water and touchup any scratched or chipped painted surfaces with a good quality paint.
8. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.
9. Seal all openings on engine with plastic bags and tape.
10. Store the engine in a dry protected place. If engine must be stored outside, cover it with a waterproof canvas or other suitable protective material and use a strong waterproof tape.

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Remove Engine from Long Term Storage

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

1. Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.
2. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
3. Install fan/alternator belt if removed.
4. Check for filled fuel tank.
5. Perform all appropriate prestarting checks. Refer to Maintenance/Daily or Every 10 Hours.

IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

6. Crank engine for 20 seconds with starter (do not allow the engine to start). Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.
7. Start engine and run at no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
8. On the first day of operation after storage, check overall engine for leaks and check all gauges for correct operation.

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General Engine Pack Specifications

ITEM	UNIT OF MEASURE	3029TFU80	4045HFU82 - 80 kVA	4045HFU82 - 100 kVA	4045HFU82 - 120 kVA
Number of Cylinders		3	4	4	4
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	110	127	127	127
Displacement	L	2.9	4.5	4.5	4.5
Compression Ratio		17.2:1	19.0:1	19.0:1	19.0:1
POWER[a] at 1500 rpm (Prime)	kW (hp)	28(38)	76 (103)	94 (127)	112 (152)
POWER[a] at 1500 rpm (Standby)	kW (hp)	31 (42)	83 (113)	103 (140)	123 (167)
POWER[a] at 1800 rpm (Prime)	kW (hp)	33 (45)	78 (106)	96 (131)	115 (156)
POWER[a] at 1800 rpm (Standby)	kW (hp)	36 (49)	86 (117)	106 (144)	126 (171)
Width (overall)	mm	590	755	755	755
Length (overall)	mm	888	1359	1359	1359
Height (overall)	mm	1005	1155	1155	1155
Weight (dry)[b]	kg	363	598	598	598
Engine oil quantity	L	8	15	15	15
Engine coolant quantity	L	11	20	20	20

[a]With Fan
[b]Approximate

ITEM	UNIT OF MEASURE	6068HFU82 - 150 kVA	6068HFU82 - 200 kVA	6090HFU84 - 250 kVA	6090HFU84 - 300 kVA
Number of Cylinders		6	6	6	6
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	118.4	118.4
Stroke	mm	127	127	136	136
Displacement	L	6.8	6.8	9.0	9.0
Compression Ratio		19.0:1	19.0:1	16.0:1	16.0:1
POWER[a] at 1500 rpm (Prime)	kW (hp)	139 (189)	184 (250)	233 (317)	277 (376)
POWER[a] at 1500 rpm (Standby)	kW (hp)	153 (208)	202 (274)	256 (348)	304 (413)
POWER[a] at 1800 rpm (Prime)	kW (hp)	142 (193)	193 (262)	237 (321)	282 (378)
POWER[a] at 1800 rpm (Standby)	kW (hp)	156 (212)	212 (288)	260 (353)	315 (428)
Width (overall)	mm	819	819	1072	1072
Length (overall)	mm	1524	1524	1755	1755
Height (overall)	mm	1387	1387	1625	1625
Weight (dry)[b]	kg	750	750	1089	1089
Engine oil quantity	L	20	32	40	40
Engine coolant quantity	L	27	27	36	36

[a]With Fan
[b]Approximate

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General Bare Engine Specifications

ITEM	UNIT OF MEASURE	4045HFS86	4045HFS87	4045HFS88
Number of Cylinders		4	4	4
Fuel		Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5
Stroke	mm	127	127	127
Displacement	L	4.5	4.5	4.5
Compression Ratio		19.0:1	19.0:1	19.0:1
POWER[a] at 1500 rpm (Prime)	kW (hp)	76 (103)	94 (127)	112 (152)
POWER[a] at 1500 rpm (Standby)	kW (hp)	83 (113)	103 (140)	123 (167)
POWER[a] at 1800 rpm (Prime)	kW (hp)	78 (106)	96 (131)	115 (156)
POWER[a] at 1800 rpm (Standby)	kW (hp)	86 (117)	106 (144)	126 (171)
Width (overall)	mm	612	612	612
Length (overall)	mm	860	860	860
Height (overall)	mm	1039	1039	1039
Weight (dry)[b]	kg	491	491	491
Engine oil quantity	L	14	14	14

[a] *With Fan*
[b] *Approximate*

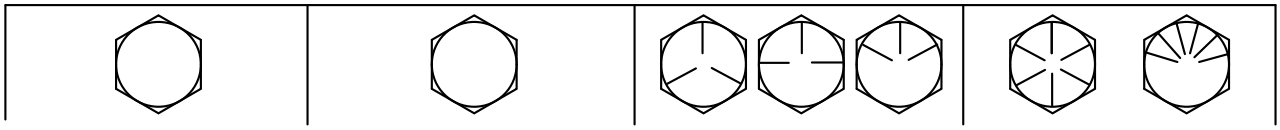
ITEM	UNIT OF MEASURE	6068HFS85	6068HFS86
Number of Cylinders		6	6
Fuel		Diesel	Diesel
Bore	mm	106.5	106.5
Stroke	mm	127	127
Displacement	L	6.8	6.8
Compression Ratio		19.0:1	19.0:1
POWER[a] at 1500 rpm (Prime)	kW (hp)	139 (189)	184 (250)
POWER[a] at 1500 rpm (Standby)	kW (hp)	153 (208)	202 (275)
POWER[a] at 1800 rpm (Prime)	kW (hp)	142 (193)	193 (262)
POWER[a] at 1800 rpm (Standby)	kW (hp)	157 (214)	212 (288)
Width (overall)	mm	657	657
Length (overall)	mm	1123	1123
Height (overall)	mm	1036	1036
Weight (dry)[b]	kg	608	608
Engine oil quantity	L	20	32

[a] *With Fan*
[b] *Approximate*

CD03523,00002DF -19-23DEC10-1/1

Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



Bolt or Screw Size	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N·m	lb.-ft.	N·m	lb.-ft.
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N·m	lb.-ft.	N·m	lb.-ft.				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N·m	lb.-ft.														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a]Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

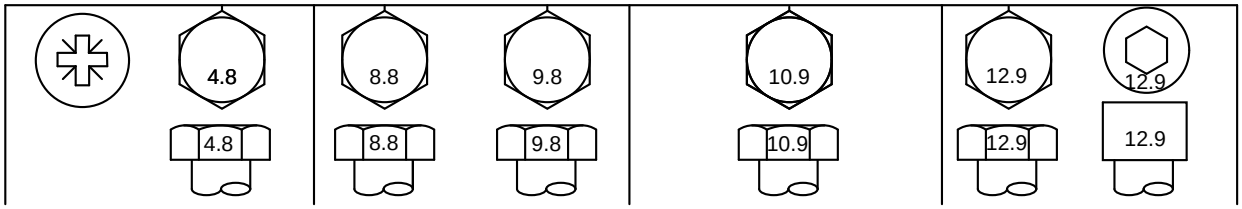
[b]"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.

[c]"Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B, F13E or F13H zinc flake coating.

DX,TORQ1 -19-12JAN11-1/1

Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or Screw Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N·m	lb.-ft.														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] *"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.*

[b] *"Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B, F13E or F13H zinc flake coating.*

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9.2. Appendix B - Alternator user and maintenance manual

User guide and maintenance manual

LEROY SOMER

Alternator

43.2 & 44.2
SHUNT, AREP & PMG

3434 i
01/10/2010

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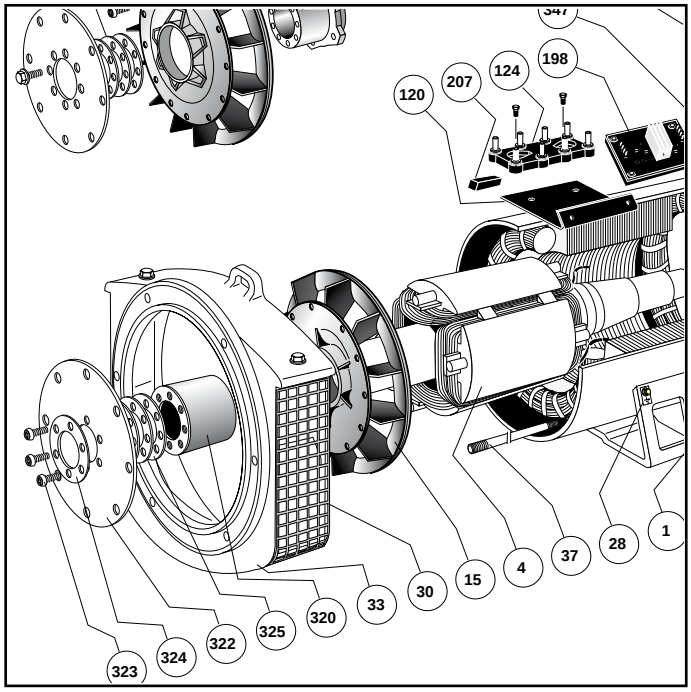
LEROY SOMER

3434 en - 2010 .10 / i

This manual is to be given to the end user



LSA 43.2/44.2 - 4 POLE

ALTERNATORS

Installation and maintenance

LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

This manual concerns the alternator which you have just purchased.

The latest addition to a whole new generation of alternators, this range benefits from the experience of the world's leading manufacturer, using advanced technology and incorporating strict quality control.

SAFETY MEASURES

Before using your alternator for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this alternator must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to potential risk of accident. It is vital that you understand and take notice of the different warning symbols used.

CAUTION

Warning symbol for an operation capable of damaging or destroying the alternator or surrounding equipment.

Warning symbol for general danger to personnel.

Warning symbol for electrical danger to personnel.

Note: LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

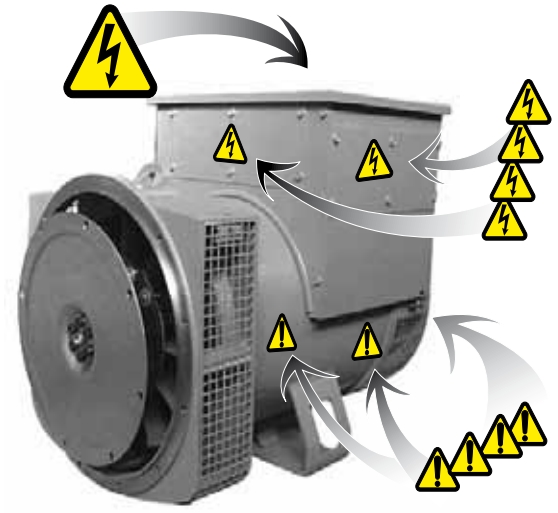
WARNING SYMBOLS

We would like to draw your attention to the following two safety measures that must be complied with:

a) During operation, do not allow anyone to stand in front of the air outlet guards, in case anything is ejected from them.

b) Do not allow children younger than 14 to go near the air outlet guards.

A set of self-adhesive stickers depicting the various warning symbols is included with this maintenance manual. They should be positioned as shown in the drawing below once the alternator has been fully installed.



WARNING

The alternators must not be put into service until the machines in which they are to be incorporated have been declared compliant with Directives EC plus any other directives that may be applicable.

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LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

1 - RECEIPT

1.1 - Standards and safety measures

Our alternators comply with most international standards.

See the EC Declaration of Incorporation on the last page.

1.2 - Inspection

On receipt of your alternator, check that it has not suffered any damage in transit. If there are obvious signs of knocks, contact the transporter (you may able to claim on their insurance) and after a visual check, turn the machine by hand to detect any malfunction.

1.3 - Identification

The alternator is identified by means of a nameplate glued to the frame.

Make sure that the nameplate on the alternator conforms to your order.

The alternator name is defined according to various criteria (see below).

Example of description: **LSA 43.2 M45 J6/4**

- LSA: Name used in the PARTNER range
- M: Marine
- C: Cogeneration
- T: Telecommunications
- 43.2: Machine type
- M45: Model
- J: Excitation system (C: AREP/J: SHUNT or PMG/ E: COMPOUND)
- 6/4: Winding number/number of poles

1.3.1 - Nameplate

So that you can identify your alternator quickly and accurately, we suggest you fill in its specifications on the non-contractual nameplate below.

1.4 - Storage

Prior to commissioning, machines should not be stored in humid conditions: at relative humidity levels greater than 90%, the machine insulation can drop very rapidly, to just above zero at around 100%. The state of the anti-rust protection on unpainted parts should be monitored.

For storage over an extended period, the alternator can be placed in a sealed enclosure (heatshrunk plastic for example) with dehydrating sachets inside, away from significant and frequent variations in temperature to avoid the risk of condensation during storage.

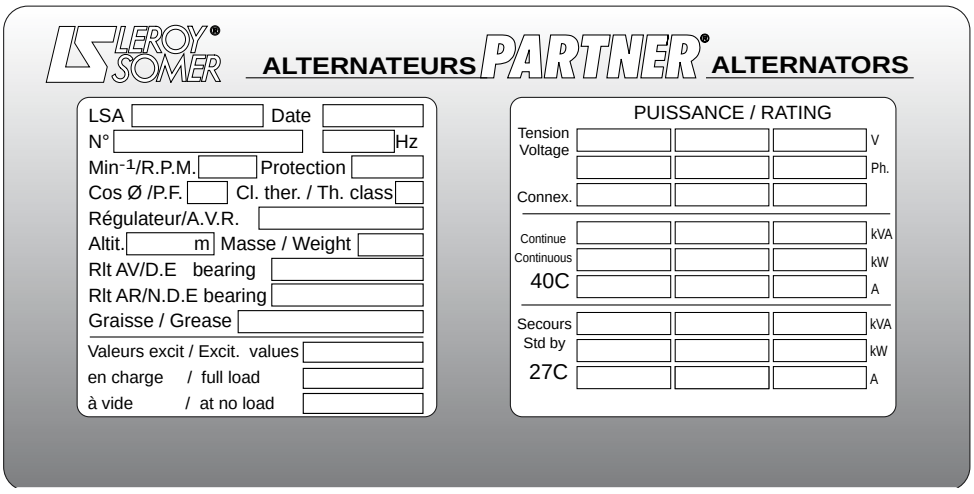
If the area is affected by vibration, try to reduce the effect of these vibrations by placing the generator on a damper support (rubber disc or similar) and turn the rotor a fraction of a turn once a fortnight to avoid marking the bearing rings.

1.5 - Applications

These alternators are designed mainly to produce electricity in the context of applications involving the use of generators.

1.6 - Contra-indications to use

Use of the alternator is restricted to operating conditions (environment, speed, voltage, power, etc.) compatible with the characteristics indicated on your genset.



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ALTERNATORS

2 - TECHNICAL CHARACTERISTICS

2.1 - Electrical characteristics

PARTNER LSA 43.2/44.2 alternators are generators without sliprings or revolving field brushes, wound as «2/3 pitch», 12-wire; the insulation is class H and the field excitation system is available in either «SHUNT», «AREP» or «PMG» versions (see AVR manual).

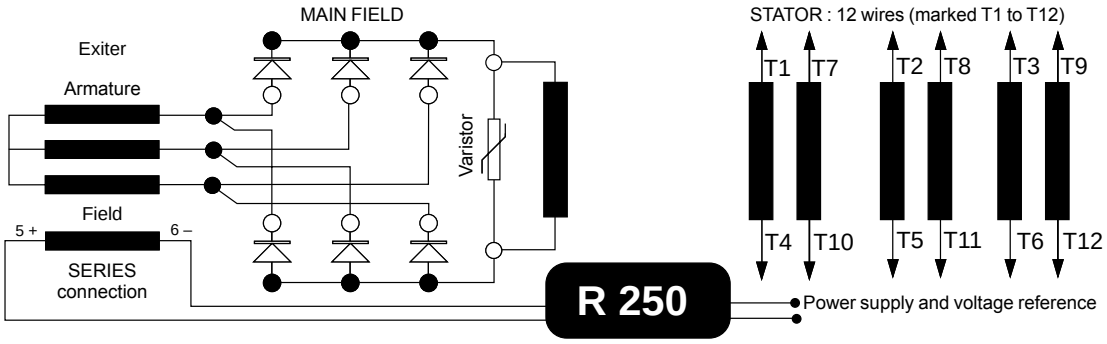
2.1.1 - Options

- Stator temperature detection probes.
- Space heaters.

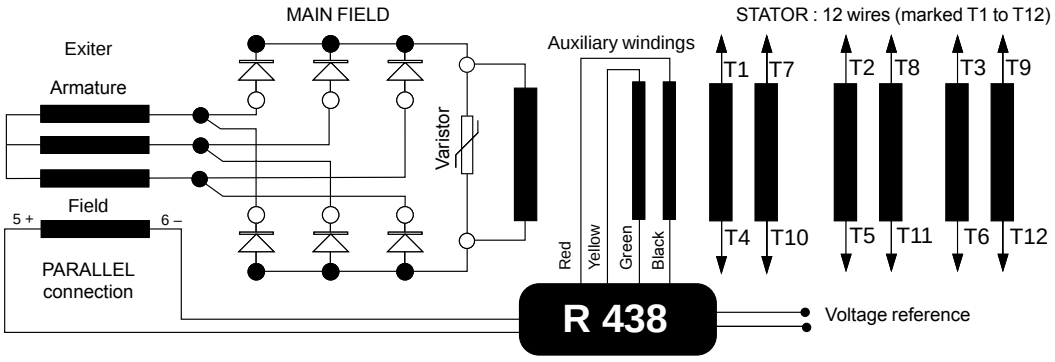
Interference suppression conforms to standard EN 55011, group 1, class B. (Europe).

2.1.2 - SHUNT system with R 250 AVR

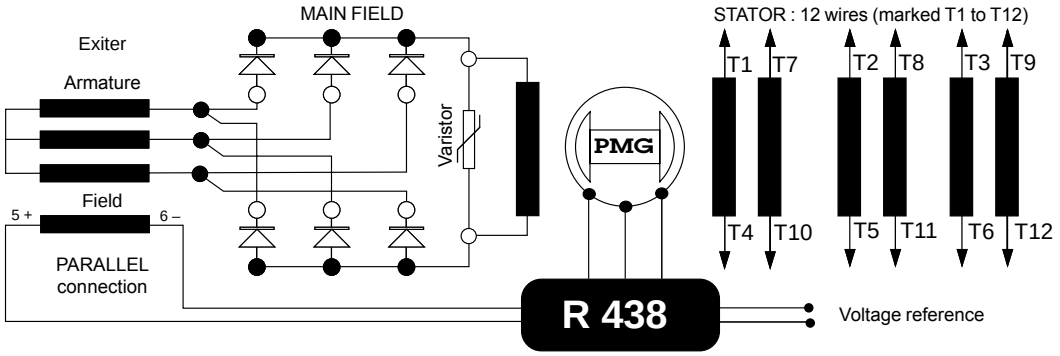
Other version R 251 AVR for dedicated single-phase or R 448 for additional function.



2.1.3 - AREP system with R 438 AVR



2.1.4 - PMG system with R 438 AVR



2.2 - Mechanical characteristics

- Steel frame
- Cast iron end shields
- Protected ball bearings, greased for life
- Mounting arrangements:

IM 1201 (MD 35) foot and flange mounted, single-bearing with SAE coupling disc.
IM 1001 (B 34) double-bearing with SAE flange and standard cylindrical shaft extension.

- Drip-proof machine, self-cooled
- Degree of protection: IP 23

2.2.1 - Options

- Air inlet filter
- Regreasable bearings (only for LSA 44.2 and SHUNT or AREP version)
- IP 44 protection

3 - INSTALLATION

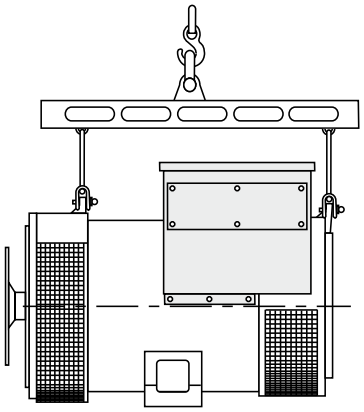
Personnel undertaking the various operations discussed in this section must wear the appropriate personal protective equipment for mechanical and electrical hazards.

3.1 - Assembly

All mechanical handling operations must be undertaken using approved equipment and the machine must be horizontal. Check how much the alternator weight (see 4.9) before choosing the lifting tool. During this operation, do not allow anyone to stand under the load.

3.1.1 - Handling

The generously-sized lifting rings are for handling the alternator alone. They must not be used to lift the genset. The choice of lifting hooks or handles should be determined by the shape of these rings. Choose a lifting system that has regard for the integrity and environment of the alternator.



3.1.2 - Coupling

3.1.2.1 - Single-bearing alternator

Before coupling the alternator and the heat engine, check they are compatible by:

- undertaking a torsional analysis of the transmission on both units
- checking the dimensions of the flywheel and its housing, the flange, coupling discs and offset.

CAUTION

When coupling the alternator to the prime mover, the holes of the coupling discs should be aligned with the flywheel holes by cranking the engine.

Do not use the alternator fan to turn the rotor.

Make sure the alternator is securely bedded in position during coupling.

Tighten the coupling disc screws to the recommended torque and check that there is lateral play on the crankshaft.

3.1.2.2 - Two-bearing alternator

- Semi-flexible coupling

Careful alignment of the alternator and the heat engine is recommended, checking that the differences in concentricity and parallelism of the two parts of the coupling do not exceed 0.1 mm.

CAUTION

This alternator has been balanced with a half-key.

3.1.3 - Location

Ensure that the ambient temperature in the room where the alternator is placed cannot exceed 40 °C for standard power ratings (for temperatures > 40 °C, apply a derating coefficient). Fresh air, free from damp and dust, must be able to circulate freely around the air intake grilles on the opposite side from the coupling.

3.2 - Inspection prior to first use

3.2.1 - Electrical checks

Under no circumstances should an alternator, new or otherwise, be operated if the insulation is less than 1 megohm for the stator and 100,000 ohms for the other windings.

There are three possible methods for restoring the above minimum values.

a) Dry out the machine for 24 hours in a drying oven at a temperature of approximately 110 °C (without the AVR).

b) Blow hot air into the air inlet, having made sure that the machine is rotating with the exciter field disconnected.

c) Run in short-circuit mode (disconnect the AVR):

- Short-circuit the three output terminals (power) using connections capable of supporting the rated current (try not to exceed 6 A/ mm^2)
- Insert a clamp ammeter to monitor the current passing through the short-circuit connections
- Connect a 48 Volt battery in series with a rheostat of approximately 10 ohms (50 W) to the exciter field terminals, respecting the polarity
- Open all the alternator openings fully
- Run the alternator at its rated speed, and adjust the exciter field current using the rheostat to obtain the rated output current in the short-circuit connections

Note: Prolonged standstill: In order to avoid these problems, we recommend the use of space heaters, as well as turning over the machine from time to time. Space heaters are only really effective if they are working continuously while the machine is stopped.

CAUTION

Ensure that the alternator has the degree of protection matching the defined environmental conditions.

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ALTERNATORS

3.2.2 - Mechanical checks

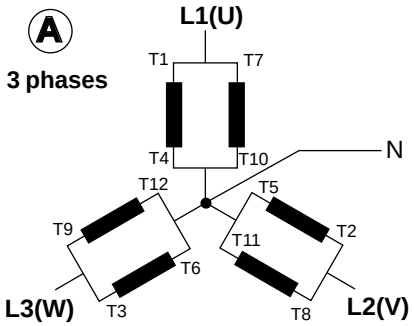
Before starting the machine for the first time, check that:
- the fixing bolts on the feet are tight,
- the cooling air is drawn in freely,
- the protective grilles and housing are correctly in place,
- the standard direction of rotation is clockwise as seen from the shaft end (phase rotation in order 1-2-3). For anti-clockwise rotation, swap 2 and 3.
- the winding connection corresponds to the site operating voltage (see section 3.3).

3.3 - Terminal connection diagrams

To modify the connection, change the position of the terminal cables. The winding code is specified on the nameplate.

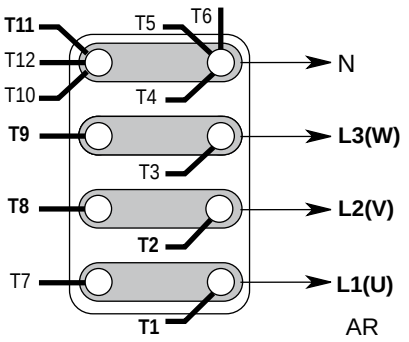
Any intervention on the alternator terminals during reconnection or checks should be performed with the machine stopped.

Connections code A — 3 phases

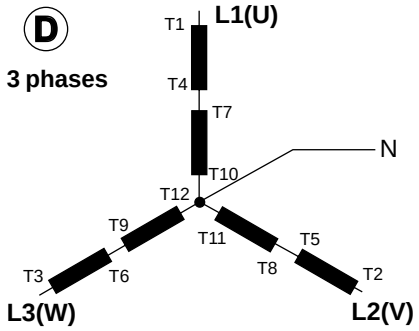


Winding	50 Hz	60 Hz
6	190 - 208	190 - 240
7	220 - 230	-
8	-	190 - 208

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 220 V => (T2)

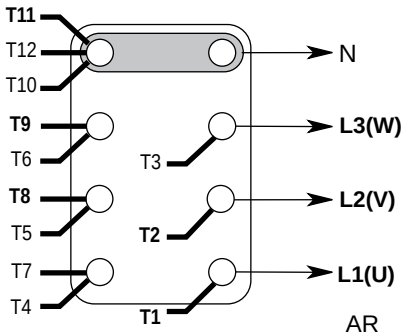


Connections code D — 3 phases

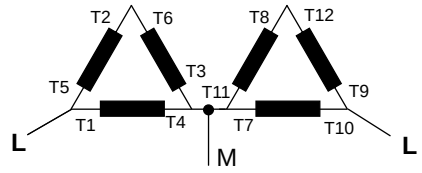


Winding	50 Hz	60 Hz
6	380 - 415	380 - 480
7	440 - 460	-
8	-	380 - 416

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 380 V => (T2)



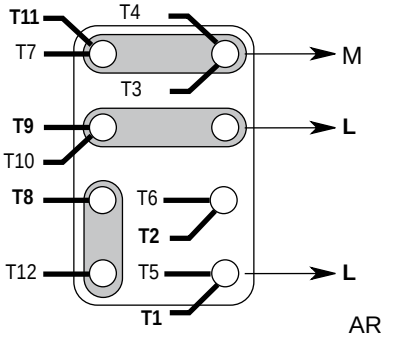
Connections code FF — 1 phase



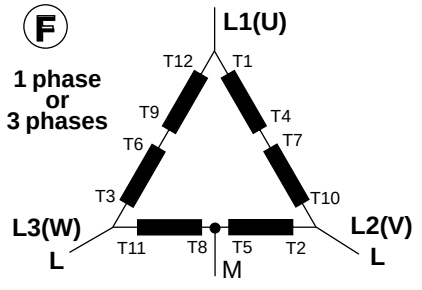
LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T1) / 110 V => (T4)
R 438 voltage sensing:
0 => (T10) / 220 V => (T1)



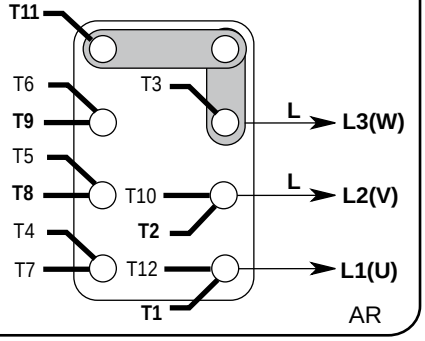
Connections code F — 1 phase or 3 phases



LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 220 V => (T2)



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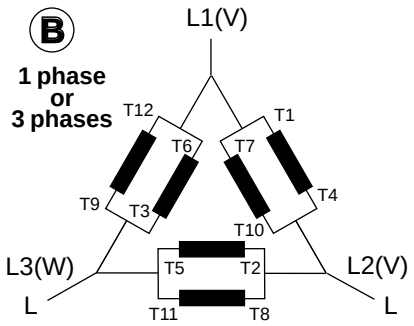
ALTERNATORS

Connection codes

B

1 phase or 3 phases

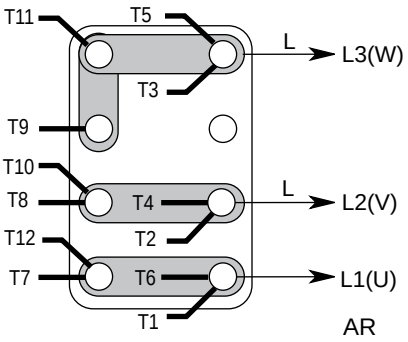


L.L. voltage

Winding	50 Hz	60 Hz
6	110 - 120	120
7	120 - 130	-
8	-	110 - 120

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 110 V => (T2)

Factory connection

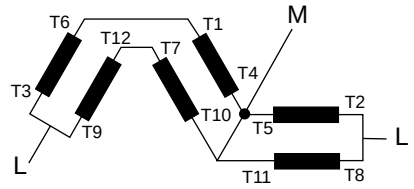


FOR LSA 44.2, THE COUPLING B IS NOT POSSIBLE

G

Connection not recommended

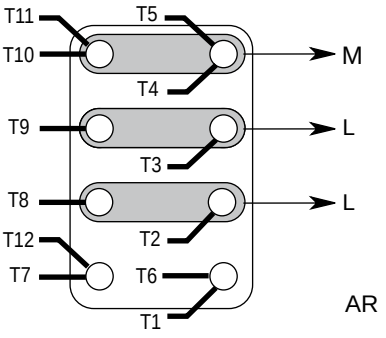
1 phase



LM voltage = 1/2 LL voltage

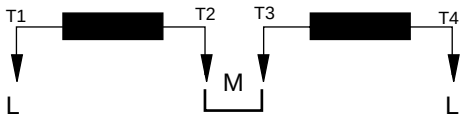
Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 220 V => (T2)



SINGLE-PHASE 4-WIRE - type M or M1 DEDICATED WINDING

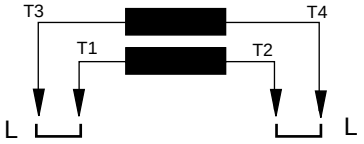
SERIAL CONNECTION



Voltage 50/60Hz			Output		
L - L	L - M	Link	L	L	M
220 230 240	110 115 120	T2 - T3	T1	T4	T2 - T3

R 251 voltage sensing: 0 => (T1) / 110 V => (T2)

PARALLEL CONNECTION (Not possible with LSA 44.2)

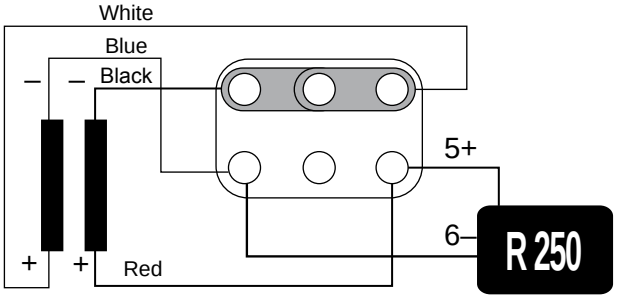


Voltage 50/60Hz			Output		
L - L	L - M	Link	L	L	M
110 115 120	- - -	T1 - T3 T2 - T4	T1-T3	T2 - T4	-

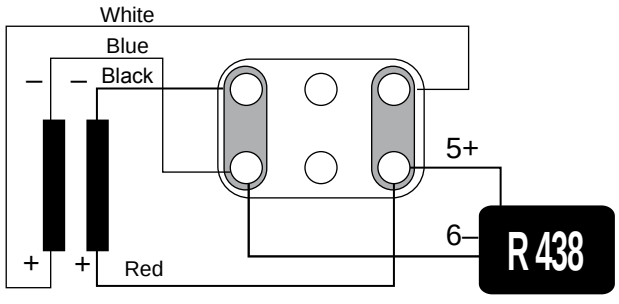
R 251 voltage sensing: 0 => (T1) / 110 V => (T2)

3.3.1 - Connexion de l'excitatrice

Series connection (shunt excitation)

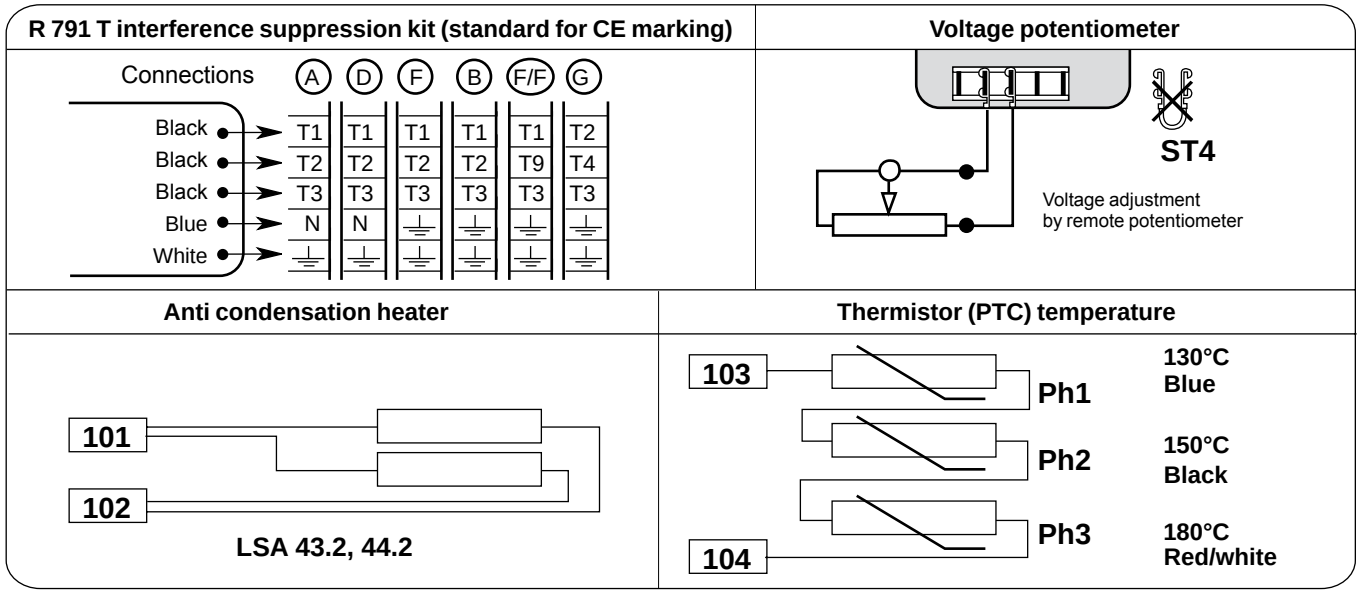


Parallel connection (AREP or PMG excitation)



Single-phase dedicated SHUNT version: R 251 AVR, no connection for 2000 (2-wire output without terminal block)

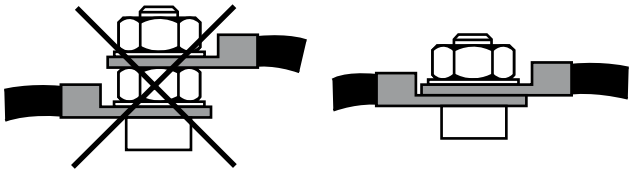
3.3.2 - Schéma de connexion des options



3.3.3 - Connection checks

Electrical installations must comply with the current legislation in force in the country of use.

Check that:
- The residual circuit-breaker complies with legislation on protection of personnel in force in the country of use, and has been correctly installed on the alternator power output as close as possible to the alternator. (In this case, disconnect the blue wire of the R 791 interference suppression module linking the neutral);
- Any protective devices in place have not tripped;
- If there is an external AVR, the connections between the alternator and the cubicle are made in accordance with the connection diagram;
- There is no short-circuit between phase or phase-neutral between the alternator output terminals and the generator set control cabinet (part of the circuit not protected by circuit-breakers or cubicle relays);
- The alternator has been connected with the busbar separating the terminals as shown in the terminal connection diagram.



- The equipotential earth links have been implemented correctly (cross-section and continuity of the earths).

3.4 - Commissioning

The alternator can only be started up and used if the installation is in accordance with the regulations and instructions defined in this manual.

The alternator is tested and set in the factory. When first used with no load, make sure that the drive speed is correct and stable (see the genset nameplate). On application of the load, the alternator should achieve its rated speed and voltage; however, in the event of abnormal operation, the alternator setting can be altered (follow the adjustment procedure: see section 3.5). If the operation is still incorrect, the cause of the malfunction must be located (see section 4.4 & 4.5).

3.5 - Setting up

The various adjustments during tests must be made by a qualified engineer. The screwdriver for making adjustments must be suitable for use with electrical equipment. It is essential that the drive speed specified on the genset nameplate is reached before commencing adjustment. The AVR is used to make any adjustments to the alternator. Access to the AVR adjustments is via the panel provided for this purpose.
After operational testing, replace all access panels or covers.

4 - SERVICING / MAINTENANCE

4.1 - Safety measures

Servicing or troubleshooting must be carried out strictly in accordance with instructions so as to avoid the risk of accidents and to maintain the alternator in its original state.

All such operations performed on the alternator should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components, who must wear the appropriate personal protective equipment for mechanical and electrical hazards.
Before carrying out any work on the alternator, ensure that it cannot be started by a manual or automatic system by isolating the power in any cabinet or enclosure and make sure you have understood the operating principles of the system.

4.2 - Regular maintenance

4.2.1 - Checks after start-up

After approximately 20 hours of operation, check that all fixing screws on the alternator are still tight, plus the general state of the alternator and the various electrical connections in the installation.

4.2.2 - Cooling circuit

It is advisable to check that circulation of air is not reduced by partial blocking of the air intake and outlet grilles: mud, fibre, grease, etc. and to check whether the ventilation guards are corroded or scratched.

4.2.3 - Bearings

The bearings are permanently greased: approximate life of the grease = 20,000 hours or 3 years.
As an option, they are regreasable for the LSA 44.2. It is advisable to lubricate the alternator during operation. Time intervals and quantity of grease are given in the table below.

NDE/DE bearing	6315 C3	6309 C3
Quantity of grease	30 g	15 g
Regreasing interval	6000 hrs	10,000 hrs

Lubrication intervals are given for grease type
LITHIUM - standard - NLGI 3.
In the factory, the grease used for lubrication is:
ESSO UNIREX N3.
Before using another grease, check for compatibility with the original one. Monitor the temperature rise in the bearings, which must not exceed 50°C above the ambient temperature. Should this value be exceeded, the alternator must be stopped and checks carried out.

4.2.4 - Electrical servicing

Cleaning product for the windings.

CAUTION

Do not use: trichlorethylene, perchlorethylene, trichloroethane or any alkaline products.

Certain strictly defined pure volatile degreasing agents can be used, such as:
- Normal petrol (without additives); inflammable
- Toluene (slightly toxic); inflammable
- Benzene (or benzine, toxic); inflammable
- Ciclohexare (non toxic); inflammable

The insulating components and the impregnation system are not at risk of damage from solvents (see the list of authorized products).
Avoid letting the cleaning product run into the slots. Apply the product with a brush, sponging frequently to avoid accumulation in the housing. Dry the winding with a dry cloth. Let any traces evaporate before reassembling the alternator.

These operations must be performed at a cleaning station, equipped with a vacuum system that collects and flushes out the products used.

4.2.5 - Mechanical servicing

CAUTION

Cleaning the machine using a water spray or a high-pressure washer is strictly prohibited.
Any problems arising from such treatment are not covered by our warranty.
The machine should be cleaned with a degreasing agent, applied using a brush. Check that the degreasing agent will not affect the paint.
Compressed air should used to remove any dust.
If filters have been added to the machine after manufacture and do not have thermal protection, the service personnel should clean the air filters periodically and systematically, as often as necessary (every day in very dusty atmospheres).
Cleaning can be performed using water for dry dust or in a bath containing soap or detergent in the case of greasy dust. Petrol or chloroethylene can also be used.
After cleaning the alternator, it is essential to check the winding insulation (see sections 3.2 and 4.8).

4.3 - Fault detection

If, when commissioned, the alternator does not work normally, the source of the malfunction must be identified.
To do this, check that:
- the protective devices are fitted correctly
- the connections comply with the diagrams in the manuals supplied with the machine
- the speed of the unit is correct (see section 1.3)
Repeat the operations defined in section 3

4.4 - Mechanical defects

Fault		Action
Bearing	Excessive overheating of one or both bearings (temperature > 80 °C on the bearing retainers with or without abnormal noise)	- If the bearing has turned blue or if the grease has turned black, change the bearing. - Bearing not properly seated. - End shields misaligned (flanges not properly fitted).
Temperature abnormal	Excessive overheating of alternator frame (more than 40 °C above the ambient temperature)	- Air flow (intake-outlet) partially clogged or hot air is being recycled from the alternator or engine - Alternator operating at too high a voltage (> 105% of Un on load) - Alternator overloaded
Vibration	Excessive vibration	- Misalignment (coupling) - Defective mounting or play in coupling - Rotor balancing fault
	Excessive vibration and humming noise coming from the machine	- Alternator operating in single-phase mode (single-phase load or faulty contactor or installation fault) - Stator short-circuit
Abnormal noise	Alternator damaged by a significant impact, followed by humming and vibration	- System short-circuit - Mis-paralleling Possible consequences - Broken or damaged coupling - Broken or bent shaft end - Shifting and short-circuit of main field - Fan fractured or coming loose on shaft - Irreparable damage to rotating diodes or AVR

4.5 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect between E- and E+ a new battery of 4 to 12 volts, respecting the AVR polarities, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed.	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed.	- Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings disconnected - Main field winding open circuit. Check the resistance
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Main field winding short-circuited - Check the resistance
		Speed too low	Increase the drive speed (Do not touch the AVR voltage pot. (P2) before running at the correct speed.)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	Faulty AVR
Voltage oscillations	Adjust AVR stability potentiometer	If no effect: try normal/rapid recovery modes (ST2)	- Check the speed: possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or LAM set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between E+ and E- on the AVR	Voltage between E+ and E- SHUNT < 20 V - AREP/PMG < 10 V	- Check the speed (or LAM set too high)
		Voltage between E+ and E- SHUNT > 30 V - AREP/PMG > 15 V	- Faulty rotating diodes - Short-circuit in the main field. Check the resistance - Faulty exciter armature
(*) Caution: For single-phase operation, check that the sensing wires coming from the AVR are correctly connected to the operating terminals			
Voltage disappears during operation (**)	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Main field open circuit or short-circuited
(**) Caution: Internal protection may be activated (overload, open circuit, short-circuit)			

4.5.1 - Checking the winding

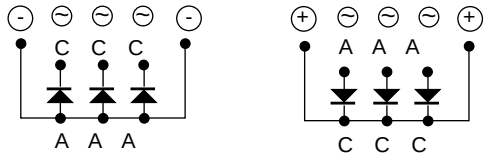
You can check the winding insulation by performing a high voltage test. In this case, you must disconnect all AVR wires.

CAUTION

Damage caused to the AVR in such conditions is not covered by our warranty.

4.5.2 - Checking the diode bridge

LSA 43.2 / 44.2 diode bridge



A diode in good working condition allows the current to flow in only one direction, from anode to cathode.

4.5.3 - Checking the windings and rotating diodes using separate excitation

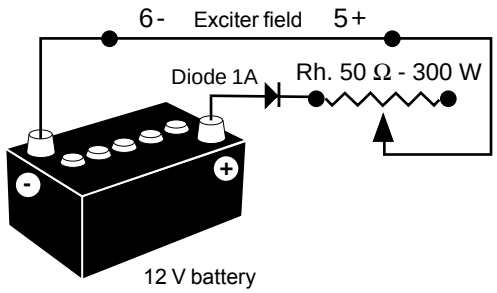
During this procedure, make sure that the alternator is disconnected from any external load and inspect the terminal box to check that the connections are fully tightened.

1) Stop the unit, disconnect and isolate the AVR wires.

2) There are two ways of creating an assembly with separate excitation.

Assembly A: Connect a 12 V battery in series with a rheostat of approximately 50 ohms - 300 W and a diode on both exciter field wires (5+) and (6-).

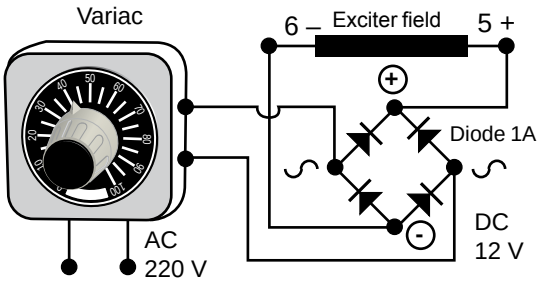
Assembly A



Assembly B: Connect a «Variac» variable power supply and a diode bridge on both exciter field wires (5+) and (6-).
Both these systems should have characteristics which are compatible with the field excitation power of the machine (see the genset nameplate).

3) Run the unit at its rated speed.

4) Gradually increase the exciter field supply current by adjusting the rheostat or the Variac and measure the output voltages on L1 - L2 - L3, checking the excitation voltage at no load (see machine nameplate or ask for the factory test report).
When the output voltage is at its rated value and balanced within 1% for the rated excitation level, the machine is in good working order. The fault therefore comes from the AVR or its associated wiring (ie. sensing, auxiliary windings).



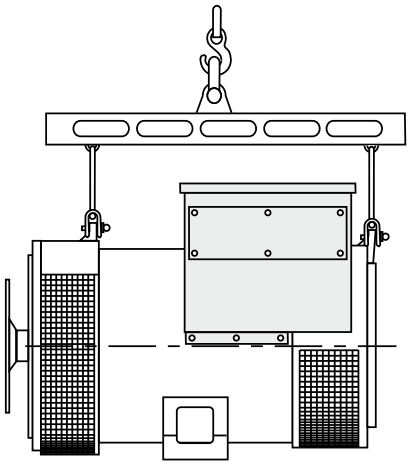
Assembly B

4.6 - Dismantling, reassembly

(see sections 5.4.1/5.4.2 & 5.4.3)

During the warranty period, this operation should only be carried out in an LEROY-SOMER approved workshop or in our factory, otherwise the warranty may be invalidated.

Whilst being handled, the alternator should remain horizontal (translational movement of rotor not locked). Check how much the alternator weighs (see section 4.9) before choosing the lifting method.
The choice of lifting hooks or handles should be determined by the shape of the lifting rings.



4.6.1 - Tools required

To fully dismantle the machine, we recommend using the tools listed below:
- 1 ratchet spanner + extension
- 1 torque wrench
- 1 set of flat spanners: 7 mm, 8 mm, 10 mm, 12 mm
- 1 socket set: 8 mm, 10 mm, 13 mm, 16 mm, 18 mm, 21 mm, 22 mm, 24 mm
- 1 size 5 Allen key (eg. Facom: ET5)
- 1 size 6 Allen key (eg. Facom: ET6)
- 1 size 10 Allen key (eg. Facom: ET10)
- 1 size 14 Allen key (eg. Facom: ET14)
- 1 T20 and T30 TORX bit
- 1 puller (eg. Facom: U35)
- 1 puller (eg. Facom: U32/350).

4.6.2 - Screw tightening torque

IDENTIFICATION	screw Ø	Torque N.m
Field terminal block screw	M4	4 N.m
Field screw	M6	10 N.m
Diode bridge/RP	M6	5 N.m
Diode nut	M5	4 N.m
43.2 tie rod	M12	57 N.m
44.2 tie rod	M14	90 N.m
Earth screw	M8	26 N.m
43.2 disc/shaft screw	M12	110 N.m
44.2 disc/shaft screw	M16	250 N.m
44.2 turbine screw	M6	5 N.m
Grille screws	M6	5 N.m
Cover screws	M6	5 N.m
Terminal block nut	M10	20 N.m

4.6.3 - Access to connections and the regulation system

The terminals are accessed directly by removing the terminal box lid [48].
To access the AVR adjustment potentiometers, the side plate [367] should be removed.

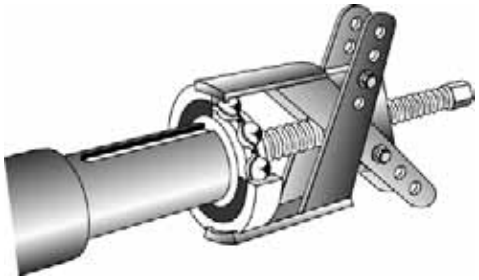
4.6.4 - Accessing, checking and replacing diodes

4.6.4.1 - Dismantling
- Remove the air intake grille [51]
- Remove the surge suppressor [347]
- Disconnect the 6 diodes using an ohmmeter or a battery lamp (see section 4.5.2)

4.6.4.2 - Reassembly
- Replace the bridges, respecting the polarity (see section 4.5.1)
- Replace the surge suppressor [347]
- Refit the air intake grille [51]
- Replace the terminal box lid [48]

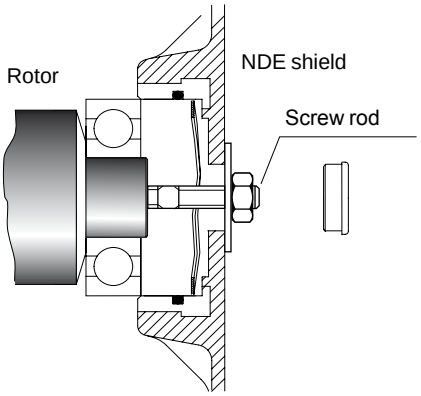
4.6.5 - Replacing the NDE bearing on single-bearing machines

4.6.5.1 - Dismantling
- Remove the terminal box lid [48]
- Remove the air intake grille [51]
- Unscrew the fixing clamps on the power output cables, remove the connector from the exciter and the R 791 module.
- Remove the 4 nuts on the tie rods
- Remove the NDE shield [36] using a puller: eg. U.32 - 350 (FACOM)
- Remove the ball bearing [70] using a screw puller



4.6.5.2 - Reassembly
- Heat the inner slipring of a new bearing by induction or in a drying oven at 80 °C (do not use an oil-bath) and fit it to the machine.
- Place the preloading wavy washer [79] in the shield and fit a new O ring seal [349].

Refit the NDE shield and pass the bundle of wires between the top bars of the shield.
- Refit the fixing clamps on the cables, the R 791 module and the exciter connector.
- Refit the air intake grille [51].
- Replace the terminal box lid [48].



4.6.6 - Replacing the bearings on two-bearing machines

4.6.6.1 - Dismantling
- Uncouple the alternator from the prime mover.
- Remove the 8 assembly screws.
- Remove the DE shield [30].
- Remove the NDE shield (see section 4.6.5.1)
- Remove both ball bearings [60] and [70] using a puller with a central screw.

4.6.6.2 - Reassembly
- Heat the new bearings by induction or in a drying oven at 80°C (do not use an oil-bath) and fit them to the machine.
- Check that both the preloading wavy washer [79] and the new O ring seal [349] have been fitted on the NDE shield [36].

Refit the NDE shield and pass the bundle of wires between the top bars of the shield.
- Refit the DE shield [30] and tighten the 4 fixing screws.
- Check that the machine assembly is correctly mounted and that all screws are tightened.

4.4.6.7 - Accessing the main field and stator

4.6.7.1 - Dismantling

Follow the procedure for dismantling the bearings (see sections 4.6.5.1 and 4.6.6.1)

- Remove the coupling disc (single-bearing alternator) or the DE shield (two-bearing alternator) and insert a tube of the corresponding diameter on the shaft end.
- Rest the rotor on one of its poles, then slide it out. Use the tube as a lever arm to assist dismantling.
- After extraction of the rotor, be careful not to damage the fan. If the fan is dismantled, it is essential that it is replaced for the 43.2.

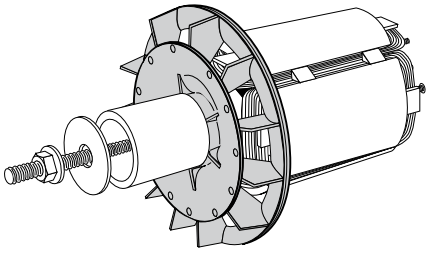
NOTE: If intervention is required on the main field (rewinding, replacement of components), the rotor assembly must be rebalanced.

4.6.7.2 - Reassembling the main field

- Follow the dismantling procedure in reverse order.

Take care not to knock the windings when refitting the rotor in the stator.

- If the fan is being replaced on the 43.2, assemble the parts as shown in the following diagram. Fit a tube and a threaded screw. On the 44.2 the fan is fixed by screws on the hub.



Follow the procedure for reassembling the bearings (see sections 4.6.5.2 and 4.6.6.2).

After operational testing, replace all access panels or covers.

4.7 - Installation and maintenance of the PMG

For the LSA 43.2 and LSA 44.2, the PMG reference is PMG 1. See the PMG maintenance manual, ref: 4211.

CAUTION

Mounting is impossible with the «regreasable bearings» option with the LSA 44.2.

4.8 - Electrical characteristics

Table of average values:
Alternator - 2 and 4 poles - 50 Hz/60 Hz - Winding n° 6 and M or M1 connected in dedicated single-phase. (400 V for the excitation values).
The voltage and current values are given for no-load operation and operation at rated load with separate field excitation. All values are given at ± 10% (for exact values, consult the test report) and are subject to change without prior warning. For 60 Hz machines, the resistance values are the same and the excitation current «i exc» is approximately 5 to 10% weaker.

4.8.1 - 3-phase LSA 43.2 4 P, SHUNT excitation

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Field	Armature
S1	0.155	1.35	18.4	0.23
S15	0.155	1.35	18.4	0.23
S25	0.155	1.35	18.4	0.23
S35	0.128	1.41	18.4	0.23
M45	0.105	1.57	18.4	0.23
L65	0.083	1.76	18.4	0.23
L8	0.063	1.96	18.4	0.23

Field excitation current i exc (A) - 400 V - 50 Hz
«i exc»: excitation current of the exciter field

LSA 43.2	no load	on load
S1	0.5	1.3
S15	0.5	1.5
S25	0.5	1.6
S35	0.5	1.8
M45	0.4	1.6
L65	0.4	1.6
L8	0.4	1.6

4.8.2 - 3-phase LSA 43.2 4 P, AREP excitation

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Wind. X1,X2	Widing. Z1,Z2	Field	Armat.
S1	0.155	1.35	0.32	0.52	4.6	0.23
S15	0.155	1.35	0.32	0.52	4.6	0.23
S25	0.155	1.35	0.32	0.52	4.6	0.23
S35	0.128	1.41	0.29	0.5	4.6	0.23
M45	0.105	1.57	0.26	0.51	4.6	0.23
L65	0.083	1.76	0.26	0.44	4.6	0.23
L8	0.063	1.96	0.21	0.4	4.6	0.23

Field excitation current i exc (A) -400 V -50 Hz
«i exc»: excitation current of the exciter field

LSA 43.2	no load	on load
S1	1	2.6
S15	1	3
S25	1	3.2
S35	1	3.6
M45	0.8	3.2
L65	0.8	3.2
L8	0.8	3.2

4.8.3 - Dedicated single-phase LSA 43.2: 4-pole, SHUNT excitation (60 Hz only)

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Field	Armature
S1	0.058	1.35	13.9	0.23
S25	0.058	1.35	13.9	0.23
S35	0.046	1.41	13.9	0.23
M45	0.037	1.57	13.9	0.23
L65	0.027	1.76	13.9	0.23
L8	0.019	1.96	13.9	0.23

Field excitation current i exc (A) -240 V -60 Hz

«i exc»: excitation current of the exciter field

LSA 43.2	no load	on load
S1	0.59	1.44
S25	0.59	1.68
S35	0.66	1.65
M45	0.61	1.48
L65	0.62	1.48
L8	0.74	1.46

4.8.4 - 3-phase LSA 44.2: 4-pole, SHUNT excitation

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Field	Armature
VS3	0.046	2.51	18.4	0.5
VS45	0.046	2.51	18.4	0.5
S7	0.036	2.91	18.4	0.5
S75	0.036	2.91	18.4	0.5
M95	0.024	3.32	18.4	0.5
L12	0.019	3.66	18.4	0.5

Field excitation current i exc (A) - 400 V - 50 Hz

«i exc»: excitation current of the exciter field

LSA 44.2	no load	on load
VS3	0.5	1.8
VS45	0.5	2.1
S7	0.5	1.9
S75	0.5	2.1
M95	0.6	2
L12	0.5	1.9

4.8.5 - 3-phase LSA 44.2: 4-pole, AREP excitation

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Wind. X1,X2	Wind. Z1,Z2	Field	Armat.
VS3	0.046	2.51	0.3	0.5	4.9	0.5
VS45	0.046	2.51	0.3	0.5	4.9	0.5
S7	0.036	2.91	0.21	0.32	4.9	0.5
S75	0.036	2.91	0.21	0.32	4.9	0.5
M95	0.024	3.32	0.17	0.28	4.9	0.5
L12	0.019	3.66	0.16	0.21	4.9	0.5

Field excitation current i exc (A) -400 V -50 Hz

«i exc»: excitation current of the exciter field

LSA 44.2	no load	on load
VS3	1	3.6
VS45	1	4.2
S7	1	3.8
S75	1	4.2
M95	1.2	4
L12	1	3.8

4.8.6 - Dedicated single-phase LSA 44.2: 4-pole, SHUNT excitation (60 Hz only)

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Field	Armature
VS3	0.0194	2.51	18.4	0.5
VS45	0.0194	2.51	18.4	0.5
S7	0.0140	2.91	18.4	0.5
M95	0.0088	3.32	18.4	0.5

Field excitation current i exc (A) -240 V -60 Hz

«i exc»: excitation current of the exciter field

LSA 44.2	no load	on load
VS3	0.44	1.18
VS45	0.44	1.25
S7	0.43	1.2
M95	0.55	1.28

4.9 - Table of weights

LSA 43.2	Total weight (kg)	Rotor (kg)
S1	220	76
S15	220	76
S25	220	76
S35	240	80
M45	270	90
L65	290	102
L8	330	120

LSA 44.2	Total weight (kg)	Rotor (kg)
VS3	405	140
VS45	405	140
S7	460	165
S75	460	165
M95	515	185
L12	570	210

5 - SPARE PARTS

5.1 - First maintenance parts

Emergency repair kits are available as an option.
They contain the following items:

Ref.	Designation	Qty	LSA 43.2/44.2 - SHUNT	Code
198	AVR	1	R 250	AEM 110 RE 019
			R 251	AEM 110 RE 021
343	Diode bridge assembly	1	LSA 432 9 100	ALT 432 KD 001
347	Surge suppressor	1	LSA 432 1 13	AEM 000 RE 126
	AVR fuse	1	250 V - 8 A/slow-blow	

Ref.	Designation	Qty	LSA 43.2/44.2 - AREP 4 P	Code
198	AVR	1	R 438	AEM 110 RE 017
343	Diode bridge assembly	1	LSA 432 9 100	ALT 432 KD 001
347	Surge suppressor	1	LSA 432 1 13	AEM 000 RE 126
	AVR fuse	2	250 V - 8 A/fast-blow	

5.2 - Bearing designations

Ref.	Designation	Qty	LSA 43.2	Code	LSA 44.2	Code
60	Bearing on shaft extension end	1	6312 2RS/C3	RLT060ET007	6315 2RS/C3	RLT075ET004
70	Bearing on exciter end	1	6307 2RS/C3	RLT035ET030	6309 2RS/C3	RLT045ET030

5.3 - Technical support service

Our technical support service will be pleased to provide any additional information you may require.
When ordering spare parts, you should indicate the complete machine type, its serial number and the information given on the genset nameplate.

Address your enquiry to your usual contact.

CAUTION

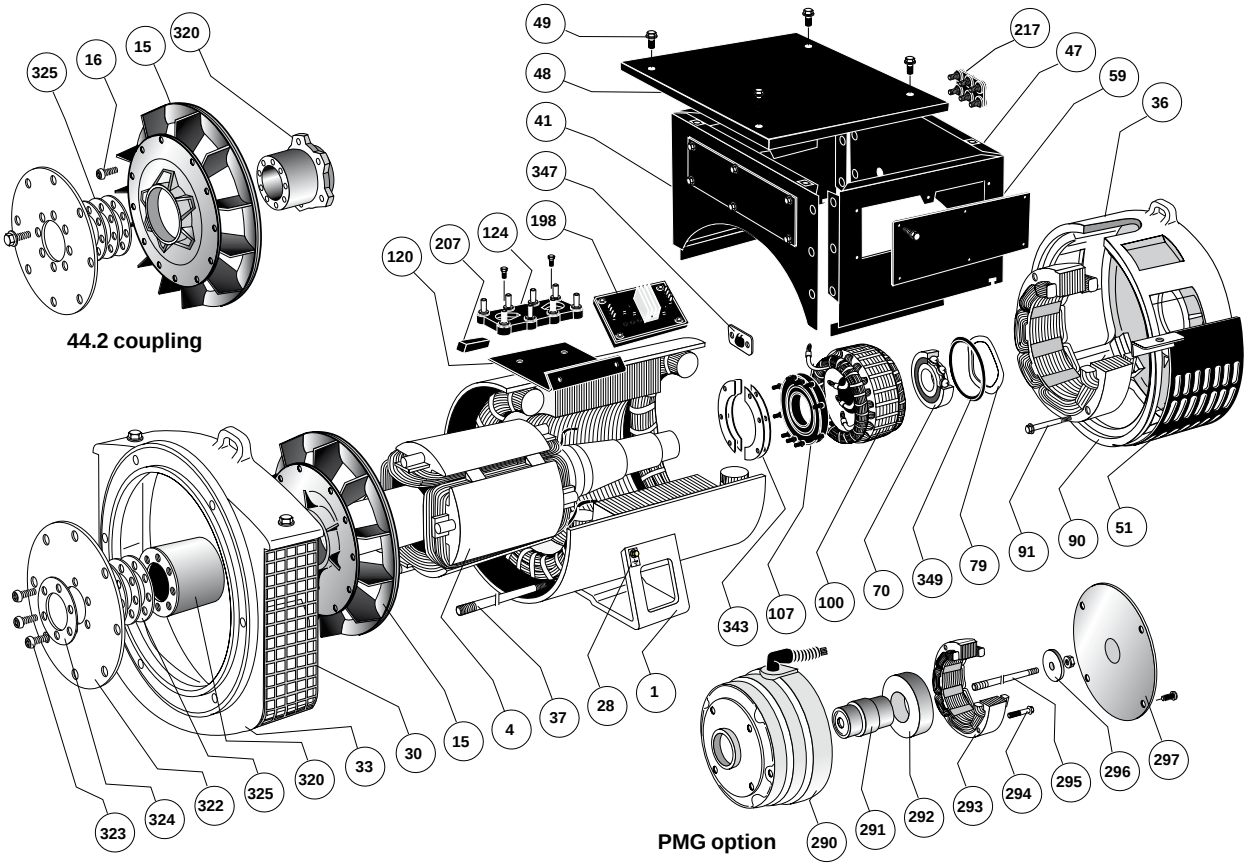
Part numbers should be identified from the exploded views and their description from the parts list.
Our extensive network of service centres can dispatch the necessary parts without delay.
To ensure correct operation and the safety of our machines, we recommend the use of original manufacturer spare parts.
In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

5.4 - Exploded views, parts list

5.4.1 - Single-bearing LSA 43.2/44.2

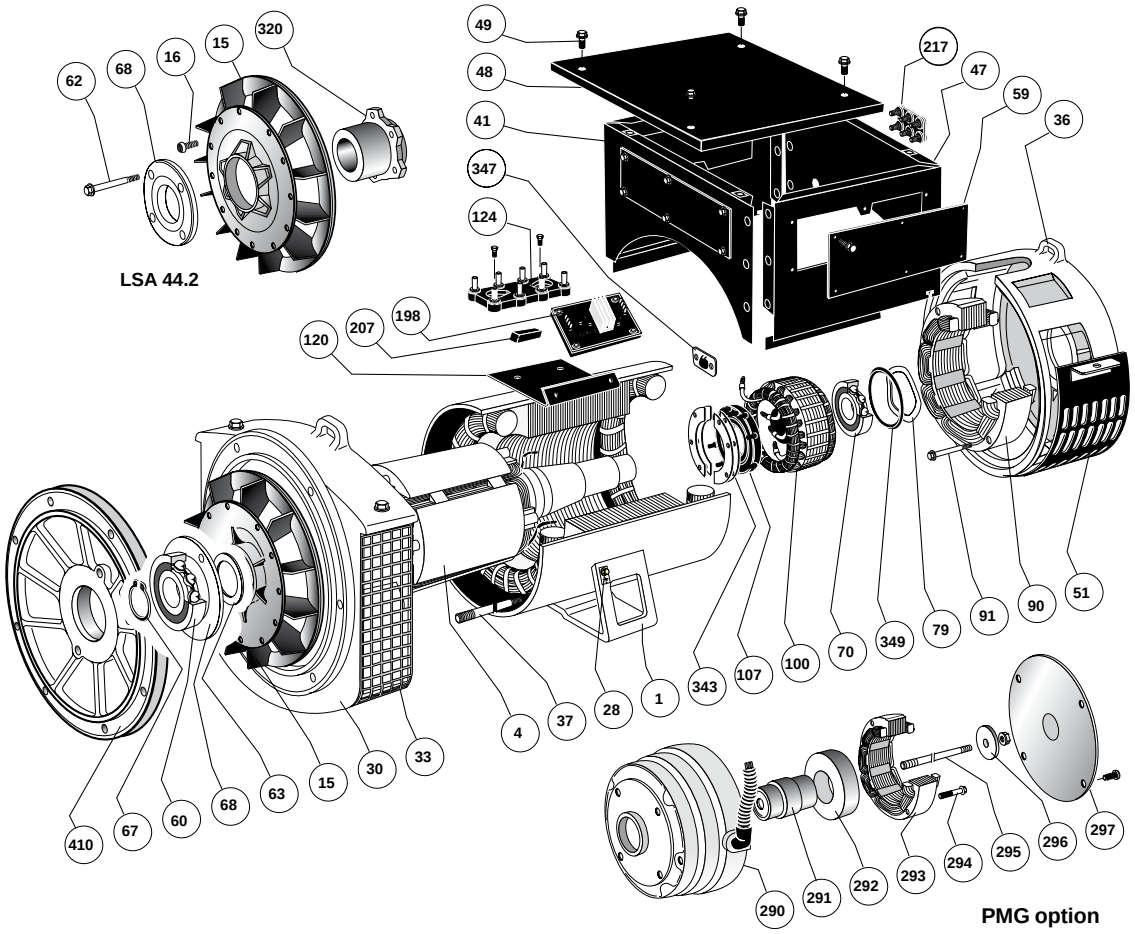


N°	Nbr	Description	N°	Nbr	Description
1	1	Stator assembly	120	1	Terminal block support (AREP)
4	1	Rotor assembly	124	1	Terminal block
15	1	Fan	198	1	Voltage regulator (AVR)
16	6	Fixing screws (44.2 only)	207	1	AVR damper seal
28	1	Earth terminal	217	1	Terminal block
30	1	DE shield	290	1	PMG housing
33	1	Air outlet grille	291	1	Adaptation shaft
36	1	Shield on exciter end	292	1	Magnetic rotor
37	4	Tie rod	293	1	Stator
41	1	Cover front panel	294	2	Fixing screws
47	1	Cover rear panel	295	1	Tie rod
48	1	Cover top panel	296	1	Cable gland washer + nut
49	34	Fixing screws	297	1	End plate
51	1	Air intake grille	320	1	Hub (43.2 L7 & 44.2 only)
59	3	Inspection door	322	1	Coupling disc
70	1	NDE bearing	323	-	Fixing screws
79	1	Preloading wavy washer	324	1	Clamping washer (43.2 S1 to L6)
90	1	Exciter field	325	-	Spacer shim (43.2 L7 & 44.2 only)
91	4	Exciter field fixing screw	343	1	Diode bridge assembly
100	1	Exciter armature	347	1	Surge suppressor
107	1	Diode crescent support	349	1	«O» ring

LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

5.4.2 - Two-bearing LSA 43.2/44.2



N°	Nbr	Description	N°	Nbr	Description
1	1	Stator assembly	90	1	Exciter field
4	1	Rotor assembly	91	4	Exciter field fixing screw
15	1	Fan	100	1	Exciter armature
16	6	Fixing screws (44.2 only)	107	1	Diode crescent support
28	1	Earth terminal	120	1	Terminal block support (AREP)
30	1	DE shield	124	1	Terminal block
33	1	Air outlet grille	198	1	Voltage regulator (AVR)
36	1	Shield on exciter end	207	1	AVR damper seal
37	4	Tie rod	217	1	Terminal block
41	1	Cover front panel	290	1	PMG housing
47	1	Cover rear panel	291	1	Adaptation shaft
48	1	Cover top panel	292	1	Magnetic rotor
49	34	Fixing screws	293	1	Stator
51	1	Air intake grille	294	2	Fixing screws
59	3	Inspection door	295	1	Tie rod
60	1	DE bearing	296	1	Cable gland washer + nut
62	2/4	Bearing retainer fixing screw	297	1	End plate
63	1	Cable gland washer (43.2 only)	320	1	Hub (44.2 only)
67	1	Circlips	343	1	Diode bridge assembly
68	1	Inner bearing retainer	347	1	Surge suppressor
70	1	NDE bearing	349	1	«O» ring
79	1	Preloading wavy washer	410	1	End shield

Electric Power Generation

DECLARATION of COMPLIANCE
related to CE marking

This Declaration applies to the generators designed to be incorporated into machines complying with the Machine Directive Nr 2006/42/CE dated 17 May 2006.

MOTEURS LEROY-SOMER
Boulevard Marcellin Leroy
16015 ANGOULEME (France)

Declares hereby that the electric generators of the ranges " PARTNER", Industrial and Professional, as well as their derivatives, manufactured by Leroy Somer or on Leroy Somer's behalf, comply with the following International Standards and Directives :

- EN et CEI 60034 -1 et 60034 -5
- ISO 8528 – 3 " Reciprocating internal combustion engine driven alternating current generating sets. Part 3. Alternating current generators for generating sets "
- The Low Voltage Directive Nr 2006/95/CE dated 12 December 2006.

Furthermore, these generators, designed in compliance with the Machine Directive Nr 2006/42, are therefore able to be incorporated into Electrical Gen-Sets complying with the following International Standards and Directives :

- The Machine Directive Nr 2006/42/CE dated 17 May 2006
- The EMC Directive Nr 2004/108/CE dated 15 December 2004, as intrinsic levels of emissions and immunity are concerned

WARNING :

The here above mentioned generators should not be commissioned until the corresponding Gen-Sets have been declared in compliance with the Directives Nr 2006/42/CE et 2004/108/CE, as well as with the other relevant Directives.

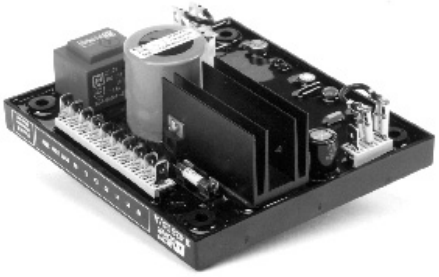
Technical Managers

P Betge – O Cadel

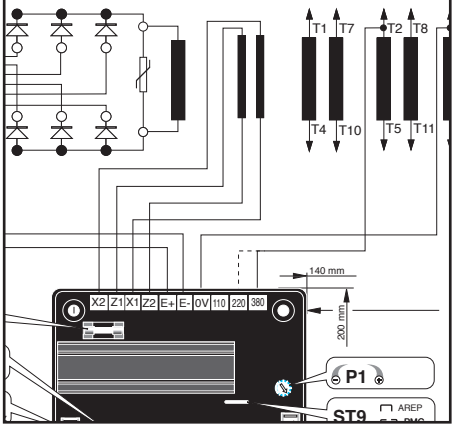
4152 en – 12.2009 / c

LEROY SOMER

3971 en - 2010.11 / f



This manual is to be given to the end user



R438

A.V.R.

Installation and maintenance

231/260

R438
A.V.R.

This manual concerns the alternator A.V.R. which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual. By following certain important points during installation, use and servicing of your A.V.R., you can look forward to many years of trouble-free operation.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional infor-mation you may require.

The various operations described in this manual are accompanied by recommen-dations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

This A.V.R. can be incorporated in a machine marked C.E.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surround-ing equipment.

Warning symbol for general danger to personnel.

Warning symbol for electrical danger to personnel.

Note: LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

R438
A.V.R.

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1.2 - PMG excitation system 5
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All such operations performed on the A.V.R. should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components.

The R438 is an IP00 product. It must be installed inside a unit so that this unit's cover can provide IP20 minimum total protection (it must only be installed on LS alternators in the appropriate location so that when viewed externally, it has a higher degree of protection than IP20).

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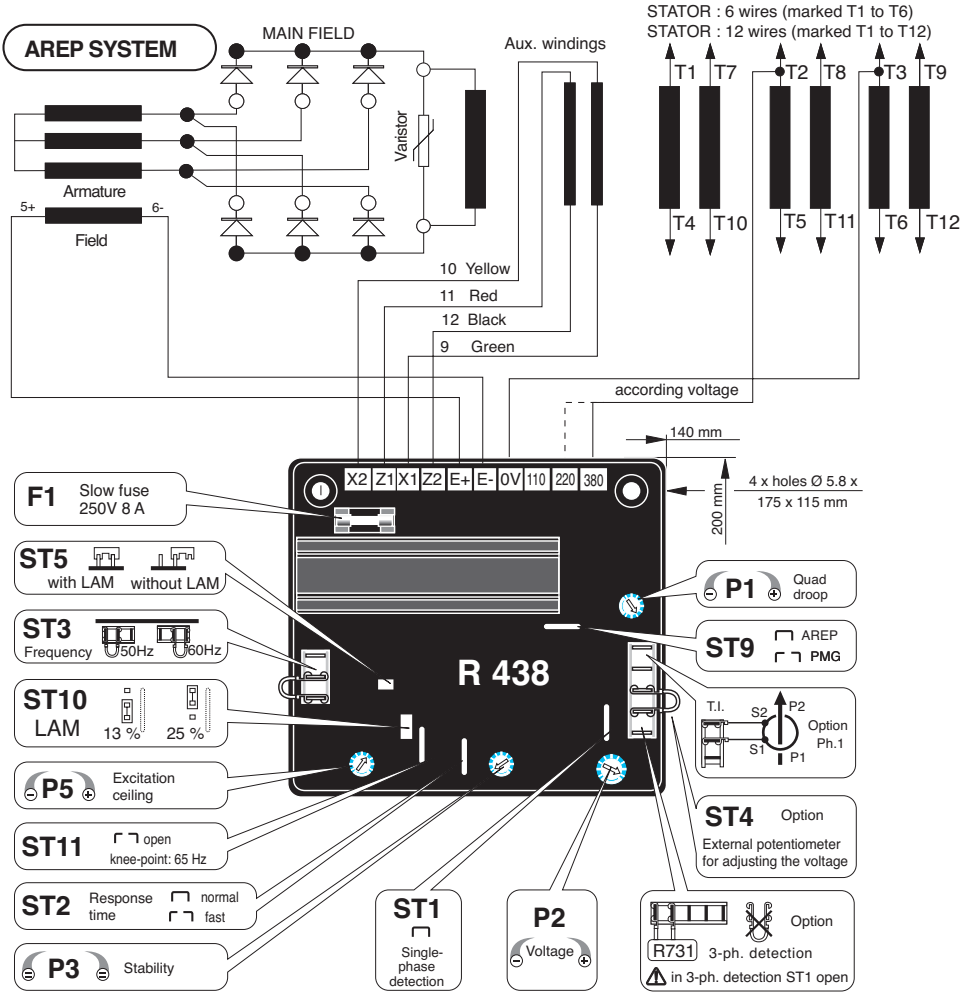
R438
A.V.R.

1 - SUPPLY

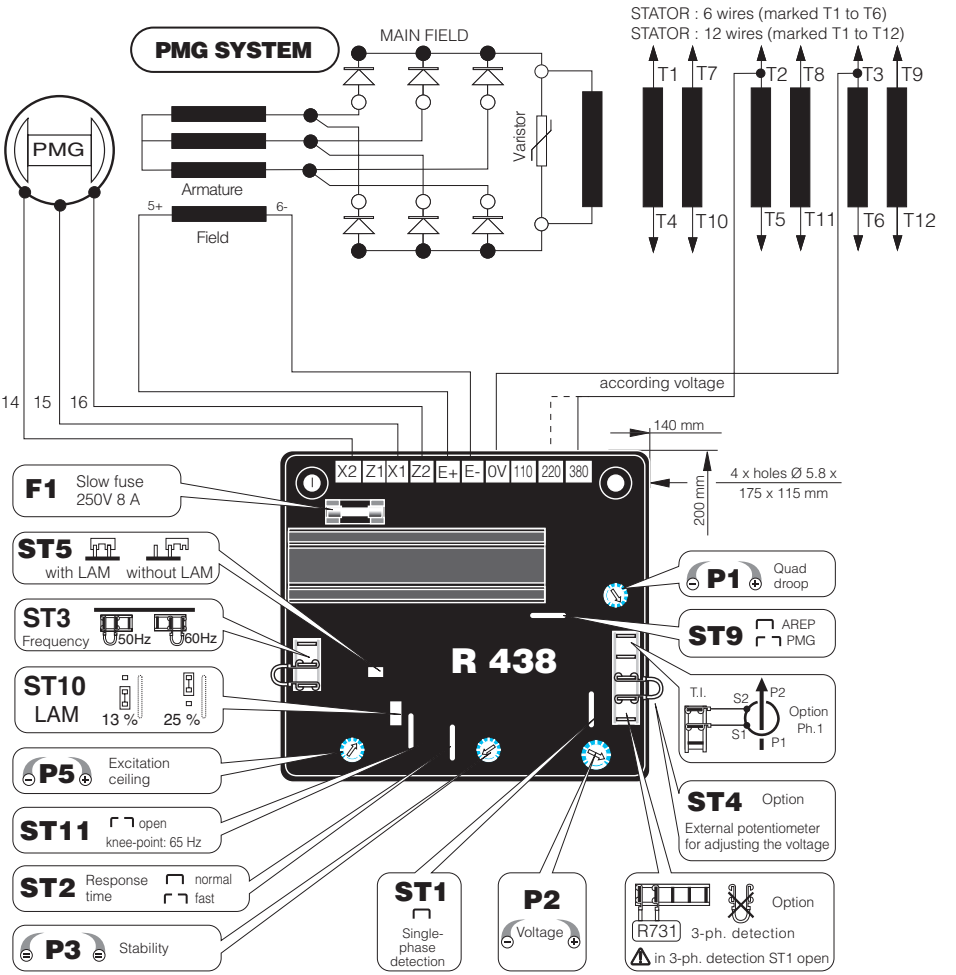
1.1 - AREP excitation system

For both AREP & PMG excitation systems, the alternator voltage regulator is the R438. With **AREP** excitation, the R438 electronic AVR is powered by two auxiliary windings which are independent of the voltage match circuit.
The first winding has a voltage in proportion to that of the alternator (characteristic Shunt), the second has a voltage in proportion to the stator current (compound characteristic: Booster effect).
The power supply voltage is rectified and filtered before being used by the AVR monitoring transistor. This principle ensures that regulation is not affected by distortions generated by the load.



1.2 - PMG excitation system

This excitation system consists of a «**PMG**» (permanent magnet generator). This is fitted at the rear of the machine and connected to the R438 AVR.
The PMG supplies the AVR with constant voltage which is independent of the main alternator winding. As a result the machine has a short-circuit current capacity and good immunity to distortions generated by the load.
The AVR monitors and corrects the alternator output voltage by adjusting the excitation current.
- 50/60 Hz selection via the **ST3** jumper.



1.3 - SHUNT or separate excitation system

A.V.R. can be operated with SHUNT supply (with a transformer / secondary 50V or a 48V battery).

2 - R438 A.V.R.

2.1 - Characteristics

- Storage : -55°C ; +85°C
- Operation : -40°C ; +70°C
- Standard power supply: AREP or PMG.
- Rated overload current: 8 A - 10 s
- Electronic protection (overload, short-circuit on opening of voltage sensing circuit): excitation overload current for 10 seconds then return to approximately 1A. The alternator must be stopped (or the power switched off) in order to reset the protection.
- Fuse : F1 on X1, X2. 8A ; slow - 250V
- Voltage sensing : 5 VA isolated via transformer ;
  - 0-110 V terminals = 95 to 140 V,
  - 0-220 V terminals = 170 to 260 V,
  - 0-380 V terminals = 340 to 520 V.
- Voltage regulation ± 1%.
- Normal or rapid response time via **ST2** jumper (see below).
- Voltage adjustment via potentiometer **P2**. other voltages via adapter transformer
- Current sensing (parallel operation): C.T. 2.5 VA cl1, secondary 1 A (optional).
- Quadrature droop adjustment via potentiometer **P1**.
- Max. excitation current adjustment via **P5** (see below).

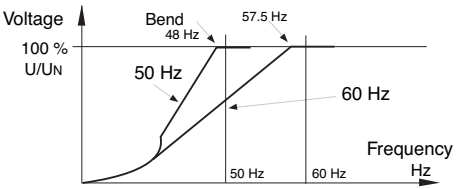
2.1.1 - Configuration jumpers function

Pot.	Delivrery config.		Position	Function
	Open	Closed		
ST1	3-ph.	Mono		Open for module installation tri detection
ST2	Fast	Normal		Response time
ST3			50 ou 60 Hz	Frequency selection
ST4	External potentio-meter	Without		Potentiometer
ST5	Without	With		LAM
ST9	Others (PMG...)	AREP		Supply
ST10			13% or 25%	LAM voltage drop amplitude
ST11	65 Hz	48 or 58 Hz		U/f function bend position

2.1.2 - Setting potentiometers function

Delivrery position	Pot.	Function
0	P1	Quadrature droop ; // operation with C.T.
400V	P2	Voltage
Centre	P3	Stability
Maxi	P5	Excitation current ceiling

2.2 - Frequency compared with voltage (without LAM)

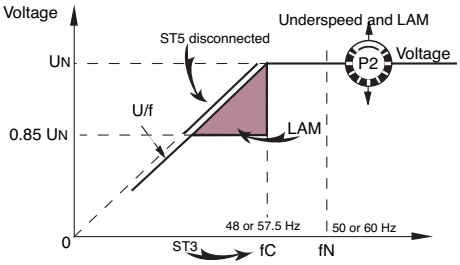


2.3 - LAM (Load Acceptance Module) characteristics

2.3.1 - Voltage drop

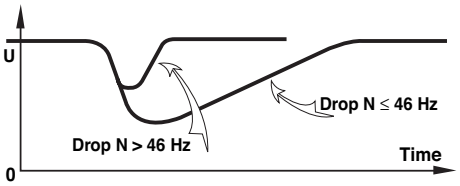
The LAM system is integrated in the R 438 AVR as standard.
Role of the «LAM» (Load Adjustment Module) :
On application of a load, the rotation speed of the generator set decreases. When it passes below the preset frequency threshold, the LAM causes the voltage to drop by approximately 13% or 25% and consequently the amount of active load applied is reduced by approximately 25% to 50%, until the speed reaches its rated value again.
Hence the LAM can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engine).
To avoid voltage oscillations, the trip threshold for the LAM function should be set approximately 2 Hz below the lowest frequency in steady state.

- LAM : action eliminated by cutting the ST5 jumper.



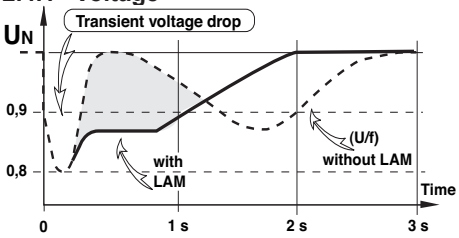
2.3.2 - Gradual voltage return function

During load impacts, the function helps the genset to return to its rated speed faster thanks to a gradual increase in voltage according to the principle:
- If the speed drops between 46 and 50 Hz, the rated voltage follows a fast gradient as it is restored.
- If the speed drops below 46 Hz, since the engine needs more help, the voltage follows a slow gradient as it returns to the reference value.

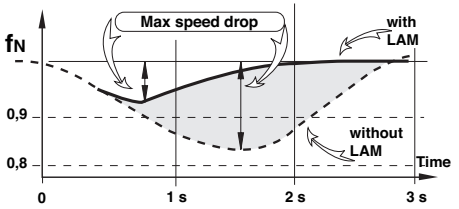


2.4 - Typical effects of the LAM with a diesel engine with or without a LAM (U/F only)

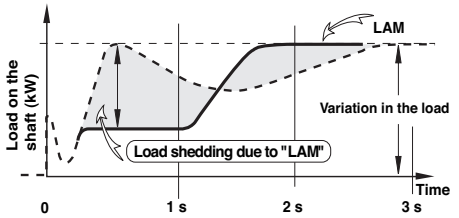
2.4.1 - Voltage



2.4.2 - Frequency



2.4.3 - Power



2.5 - R438 A.V.R. options

- **Current transformer** for parallel operation of ...../1A. 5 VA CL 1.

- **Remote voltage adjustment potentiometer**: 470 Ω, 0.5 W min: adjustment range ± 5% (range limited by internal voltage potentiometer **P2**). Remove ST4 to connect the poten-tiometer. (A 1 kΩ potentiometer can also be used to extend the adjustment range).

For wiring up the external potentiometer; the "earth" wires must be isolated as well as the potentiometer terminals (wires at the same voltage as the power).

- **R 731 external module**: sensing of 3-phase voltage 200 to 500 V, compatible with parallel operation. Disconnect ST1 to connect the module; set the voltage via the module potentiometer.

- **R 734 module**: detection of 3-phase current and voltage for parallel operation on unbalanced installations (imbalance > 15%).

- **R 726 module**: 3 functions (mounted externally).
P.F. regulation (2F) and voltage sensing circuit before paralleling (3 F).

- **Control through DC voltage** used monitoring apply to the terminals for connection of a potentiometer DC voltage :
• internal impedance 1,5 kΩ
• ± 0,5V enable a voltage setting of 10%.

3 - INSTALLATION - COMMISSIONING

3.1 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached wiring diagram.
- Check that the ST3 frequency selection jumper is on the correct frequency setting.
- Check whether the ST4 jumper or the remote adjustment potentiometer have been connected.
- Optional operating modes.
  • ST1 jumper : open to connect the R 731or R 734 3-phase sensing module.
  • ST2 jumper : open if rapid response time used
  • ST5 jumper : open to suppress the LAM function.

3.2 - Settings

The machine is tested and set at the factory. When first used with no load, make sure that the drive speed is correct and stable (see the nameplate). After operational testing, replace all access panels or covers.
The only possible adjustments to the machine should be made on the AVR.

3.2.1 - R438 settings (AREP or PMG system)

WARNING

Before any intervention on the A.V.R., make sure that the ST9 jumper is closed with AREP excitation and disconnected with PMG or SHUNT or separate excitation.

a) Initial potentiometer settings (see table below)
- Remote voltage adjustment potentiometer : centre (ST4 jumper removed).

Action	Factory setting	Pot.
Voltage minimum fully anti-clockwise	400V - 50 Hz (Input 0 - 380 V)	
Stability	Not set (centre position)	
Voltage quadrature droop (// operation with C.T.) - 0 quadrature loop fully anti-clockwise.	Not set (fully anti-clockwise)	
Excitation ceiling Limit of excitation and short-circuit current, minimum fully anti-clockwise.	10 A maximum	

Stability adjustments in standalone operation

b) Install a D.C. analogue voltmeter (needle dial) cal. 50V on terminals E+, E- and an A.C. voltmeter cal 300 - 500 or 1000V on the alternator output terminals.

c) Make sure that the **ST3** jumper is positioned on the desired frequency (50 or 60 Hz).

d) Voltage potentiometer **P2** at minimum, fully anti-clockwise.

e) Stability potentiometer **P3** to around 1/3 of the anti-clockwise limit.

f) Start the engine and set its speed to a frequency of 48 Hz for 50 Hz, or 58 for 60 Hz.

g) Set the output voltage to the desired value using **P2**.
- Rated voltage UN for solo operation (eg. 400 V)
- Or UN + 2 to 4% for parallel operation with C.T. (eg. 410 V)
If the voltage oscillates, use P3 to make adjustments (try both directions) observing the voltage between E+ and E- (approx. 10V D.C.).

The best response times are obtained at the limit of the instability. If no stable position can be obtained, try disconnecting or replacing the ST2 jumper (normal/fast).

h) Check LAM operation : **ST5** closed.

i) Vary the frequency (speed) around 48 or 58 Hz according to the operating frequency, and check the change in voltage from that observed previously (~ 15%).

j) Readjust the speed of the unit to its rated no-load value.
Adjustments in parallel operation

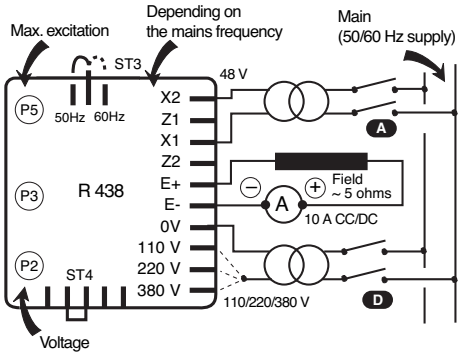
Before any intervention on the alternator, make sure that the speed droop is identical for all engines.

k) Preset for parallel operation (with C.T. connected to S1, S2)
- Potentiometer P1 (quadrature droop) in centre position.
Apply the rated load (cos φ = 0.8 inductive). The voltage should drop by 2 to 3%. If it increases, check that V and W and also S1 and S2 have not been reversed.

l) The no-load voltages should be identical for all the alternators intended to run in parallel.
- Couple the machines in parallel.
- By adjusting the **speed**, try to obtain **0 KW** power exchange.
- By altering the voltage setting P2 on one of the machines, try to cancel (or minimise) **the current** circulating between the machines.
- From now on, do not touch the voltage settings.

m) Apply the available load (the setting is only correct if a **reactive** load is available)
- By altering the **speed**, match the **kW** (or divide the rated power of the units proportionally)
- By altering the quadrature droop potentiometer **P1**, match or divide the **currents**.

3.2.2 - Max. excitation setting (excitation ceiling)



Static adjustment of the current limit, potentiometer P5 (factory setting: 7.5 A, fuse rating: 8 A - 10 seconds).

The maximum factory setting corresponds to that of the excitation current required to obtain a 3-phase short-circuit current of approximately 3 IN at 50 Hz for industrial power, unless otherwise specified(*).

A static method can be used to reduce this value or adapt the Isc to the actual operating power (derated machine), which is safer for the alternator and the installation. Disconnect power supply wires X1,X2 and Z1,Z2 and the voltage reference (0-110V-220V-380V) on the alternator.

Connect the mains power supply using a transformer (200-240V) as indicated (X1,X2 : 48V). Install a 10A D.C. ammeter in series with the exciter field. Turn P5 fully anti-clockwise and activate the power supply. If there is no output current from the AVR, turn potentiometer P2 (voltage) clockwise until the ammeter indicates a stable current. Switch the power supply off, then on again, turn P5 clockwise until the required max. current is obtained (no more than 8 A).

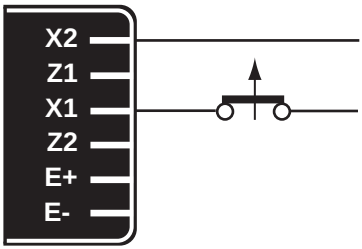
Checking the internal protection :
Open switch (D) : the excitation current should increase to its preset ceiling, remain at that level for ≥ 10 seconds and then drop to < 1A.
To reset, switch off the power supply by opening switch (A).
Note: After setting the excitation ceiling as described, adjust the voltage again (see section 2.1.1)
(*) In some countries it is a legal requirement to have a short-circuit current of 3 I_N, so as to offer selective protection.

3.2.3 - Special type of use

WARNING

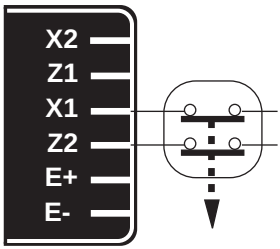
Excitation circuit E+, E- must not be left open when the machine is running : AVR damage will occur.

3.2.3.1 - R438 field weakening (SHUNT)



The exciter is switched off by disconnecting the AVR power supply (1 wire - X1 or X2). Contact rating 16 A - 250V A.C.

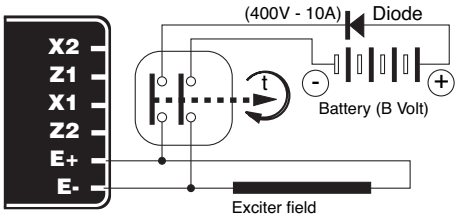
3.2.3.2 - R438 field weakening (AREP/ PMG)

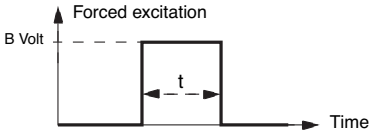


The exciter is switched off by disconnecting the AVR power supply (1 wire on each auxiliary winding) - contact rating 16 A - 250V A.C.
Connection is identical for resetting the AVR internal protection.

In case of using the de-excitation, provide a forced excitation.

3.2.3.3 - R438 field forcing





Applications	B volts	Time t
Guaranteed voltage build-up	12 (1A)	1 - 2 s
Parallel operation, de-energized	12 (1A)	1 - 2 s
Parallel operation, at standstill	12 (1A)	5 - 10 s
Frequency starting	12 (1A)	5 - 10 s
Sustained voltage on overload	12 (1A)	5 - 10 s

3.3 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 volts to terminals E- and E+, respecting the polarity, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed.	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed.	- Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings disconnected - Main field winding open circuit - check the resistance
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Main field winding short-circuited - Check the resistance
		Speed too low	Increase the drive speed (Do not touch the AVR voltage pot. (P2) before running at the correct speed.)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	Faulty AVR
Voltage oscillations	Adjust AVR stability potentiometer	If no effect : try normal / fast recovery modes (ST2)	- Check the speed : possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or U/F bend set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between E+ and E- on the AVR	Voltage between E+ and E- SHUNT < 20 V AREP / PMG < 10V	- Check the speed (or U/F bend set too high)
		Voltage between E+ and E- SHUNT > 30V AREP / PMG > 15V	- Faulty rotating diodes - Short-circuit in the main field. Check the resistance - Faulty exciter armature.
(*) Caution : For single-phase operation, check that the sensing wires coming from the AVR are correctly connected to the operating terminals			
Voltage disappears during operation (**)	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value.	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Main field open circuit or short-circuited
(**) Caution : Internal protection may be activated (overload, open circuit, short-circuit)			

Warning : after operational testing, replace all access panels or covers.

4 - SPARE PARTS

4.1 - Designation

Description	Type	Code
A.V.R.	R 438	AEM 110 RE 017

4.2 - Technical support service

Our technical support service will be happy to provide any information you require.

When ordering spare parts, you should indicate the complete machine type, its serial number and the information indicated on the nameplate.

Part numbers should be identified from the exploded views and their description in the parts list.

Our extensive network of «service stations» can dispatch the necessary parts without delay.
To ensure correct operation and the safety of our machines, we recommend the use of original manufacture spare parts.
In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

R438

NOTES

9.3. Appendix C - List of John Deere - Volvo and Perkins fault codes

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
28									**Throttle #3 Position**	
					3	■			Throttle Voltage high, short to V+	Short to V+
					4	■			Throttle Voltage low, short to V-	Short to V-
29									**Throttle #2 Position**	
					3	■			Throttle Voltage high, short to V+	Short to V+
					4	■			Throttle Voltage low, short to V-	Short to V-
					14	■			Throttle voltage out of range	
84									**Vehicle speed**	
					2	■			Vehicle invalid or missing	Not possible with Genset application
					31	■			Vehicle speed mismatch	
91	**91**		**91**	**132**			■		**Accelerator pedal position**	**FMI not determined for all VOLVO's**
					3	■			Throttle Voltage high, short to V+	Not possible with genset application, codes declared by the CAN J1587 for VOLVO.
					4	■			Throttle Voltage low, short to V-	
					7	■			Throttle calibration invalid	
					8	■		■	PWM throttle abnormal pulse width	
					9	■			Throttle invalid (CAN value)	
					10	■			Throttle voltage out of range low	
					13	■			Throttle calibration aborted	
					14	■			Throttle voltage out of range	
94			**94**				■		**Fuel rail pressure sensor**	
					1	■	■		Fuel supply pressure extremely low	
					3	■	■		Fuel rail pressure input voltage high	Short to V+
					4	■			Fuel rail pressure input voltage low	Short to V-
					5		■		Fuel rail pressure sensor open circuit	
					10	■			Fuel rail pressure lost detected	
					13	■			Fuel rail pressure higher than expected	
					16	■			Fuel supply pressure moderately high	
					17	■			Fuel rail pressure not developed	
					18	■			Fuel supply pressure moderately low	
97			**97**				■		**Water in fuel sensor**	
					0	■	■		Water in fuel continuously detected	
					3	■	■		Water in fuel input voltage high	Short to V+
					4	■			Water in fuel input voltage low	Short to V-
					16	■			Water in fuel detected	
					31	■			Water in fuel detected	
98			**98**				■		**Oil level sensor**	
					1		■		Oil level value below normal	
					3		■		Oil level sensor input voltage high	Short to V+
					4		■		Oil level sensor input voltage low	Short to V-
					5		■		Oil level sensor open circuit	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
100	**100**		**100**				■		**Oil pressure sensor**	
					1	■	■		Engine oil pressure extremely low	
					3	■	■	■	Oil pressure sensor input voltage high	Short to V+
					4	■		■	Oil pressure sensor input voltage low	Short to V-
					5		■		Oil pressure sensor open circuit	
					17			■	Engine oil pressure low	
					18	■		■	Engine oil pressure moderately low	
					31	■			Oil pressure detected, motor stopped	
102	**273**		**102**				■		**Manifold air pressure sensor**	
					0		■		Manifold air pressure above normal	
					1		■		Manifold air pressure below normal	
					2	■			Incoherent measurement of the oil pressure	
					3	■	■	■	Manifold air pressure sensor input voltage high	Short to V+
					4	■	■	■	Manifold air pressure sensor input voltage low	Short to V-
					15			■	Manifold air pressure moderately low	
					16			■	Manifold air pressure low	
103									**Turbo speed sensor**	
					0	■			Turbo speed too high	
					5	■			Turbo speed sensor circuit open	
					6	■			Sensor shorted to earth	Short to V-
					8	■			Speed signal invalid	
					31	■			Intermittent problem with speed information	
105			**105**				■		**Manifold air temperature sensor**	
					0	■	■		Manifold air temperature extremely high	
					3	■			Manifold air temperature sensor input voltage high	
					4	■	■		Manifold air temperature sensor input voltage low	
					5		■		Manifold air temperature sensor open circuit	
					15	■			Air temperature very high.	
					16	■			Manifold air temperature moderately high	
106			**106**				■		**Air inlet pressure sensor**	
					0		■		Air inlet pressure above normal	
					3		■		Air inlet pressure sensor input voltage high	
					5		■		Air inlet pressure sensor open circuit	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
107			**107**				■		**Air filter differential pressure sensor**	
					0	■	■		Air filter restriction high	
					3		■		Air filter differential pressure sensor input voltage high	
					4		■		Air filter differential pressure sensor input voltage low	
					5		■		Air filter differential pressure sensor open circuit	
					31	■			Air filter restriction high	
108	**274**		**108**				■		**Barometric pressure sensor**	**Not use with EDC III and EMS2**
					2	■			Air pressure invalid	
					3			■	High barometric pressure sensor short to high	
					4			■	High barometric pressure sensor short to low	
					17			■	High barometric pressure	ECM option, sensor not connected
110	**110**		**110**				■		**Coolant temperature sensor**	
					0	■	■	■	Coolant temperature extremely high	
					3	■	■	■	Coolant temperature sensor input voltage high	
					4	■	■	■	Coolant temperature sensor input voltage low	
					5		■		Coolant temperature sensor open circuit	
					15	■		■	Coolant temperature high least severe	
					16	■		■	Coolant temperature moderately high	
					17	■			Water temperature very low	
					31	■			Coolant temperature high	
111			**111**						**Coolant level sensor**	
					0		■		Engine coolant level low	
					1	■			Engine coolant level low	
					3	■	■		Coolant level sensor input voltage high	
					4	■			Coolant level sensor input voltage low	
153			**153**						**Crankcase pressure sensor**	
					0		■		Value above normal	
					3		■		Crankcase pressure sensor input voltage high	
					5		■		Crankcase pressure sensor open circuit	
157									**Fuel pressure sensor in the common rail**	
					1	■			Fuel pressure too low	
					3	■			Input voltage of the pressure sensor high	Short to V+
					4	■			Input voltage of the pressure sensor low	Short to V-
					10	■			Loss of fuel pressure detected	
					16	■			Fuel pressure moderately high	
					17	■			Fuel ramp pressure not reached	
					18	■			Oil pressure moderately low	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
158			**158**						**Battery voltage sensor**	
					1		■		Voltage above normal	
					17	■			ECU power down error	
160									**Wheel speed sensor**	
					2	■			Wheel speed input noise	
164		**164**							**Injection pressure control**	
168	**168**								**Electrical system voltage**	
					2			■	Electrical system voltage low	
172	**172**		**172**						**Ambient air temperature sensor**	**Inlet air temperature sensor for PERKINS**
					3			■	Ambient air temperature sensor input voltage high	Inlet air temperature sensor input voltage high
					4		■	■	Ambient air temperature sensor input voltage low	Inlet air temperature sensor input voltage low
					5		■		Ambient air temperature sensor open circuit	
					15			■		High Inlet air temperature alarm-warning
					16			■		High Inlet air temperature alarm-action alert
174	**174**								**Fuel temperature sensor**	
					0	■			Fuel temperature high most severe	
					3	■		■	Fuel temperature sensor input voltage high	
					4	■		■	Fuel temperature sensor input voltage low	
					15	■		■	Fuel temperature high	
					16	■		■	Fuel temperature moderately high	
					31	■			Fuel temperature sensor faulty	
175			**175**						**Oil temperature sensor**	
					0		■		Oil temperature extremely high	
					3		■		Oil temperature sensor input voltage high	
					4		■		Oil temperature sensor input voltage low	
					5		■		Oil temperature sensor open circuit	
177									**Transmission oil temperature sensor**	
					9	■			Transmission oil temperature invalid	Not possible with Genset application
189									**Rated engine speed**	
					0	■			Engine speed de rated	
					31	■			Engine speed de rated	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
190	**190**		**190**				■		**Engine speed sensor**	
					0	■		■	Overspeed extreme	
					2			■	Engine speed sensor data intermittent	
					9			■	Engine speed sensor abnormal update	
					11			■	Engine speed sensor signal lost	
					12			■	Engine speed sensor signal lost	
					15			■	Overspeed	
					16	■		■	Overspeed moderate	
228	**261**								**Speed sensor calibration**	
					13			■	Engine timing abnormal calibration	
252	**252**								**Software**	
					11			■	Incorrect engine software	
234	**253**								**Check system parameters**	
					2			■	Incorrect parameters	
281	**281**								**Action alert output status**	
					3			■	Action alert output open/short to B+	
					4			■	Action alert output short to ground	
					5			■	Action alert output open circuit	
282	**282**								**Overspeed output status**	
					3			■	Overspeed output open/short to B+	
					4			■	Overspeed output short to ground	
285	**285**								**Coolant temperature output status**	
					3			■	Coolant temperature lamp open/short to B+	
					4			■	Coolant temperature lamp short to ground	
286	**286**								**Oil pressure output status**	
					3			■	Oil pressure output open/short to B+	
					4			■	Oil pressure output short to ground	
					5			■	Oil pressure output open circuit	
323	**323**								**Shutdown output status**	
					3			■	Shutdown output open/short to B+	
					4			■	Shutdown output short to ground	
					5			■	Shutdown output open circuit	
324	**324**								**Warning output status**	
					3			■	Warning output open/short to B+	
					4			■	Warning output short to ground	
					5			■	Warning output open circuit	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
412									**Temperature sensor in the EGR valve.**	
					0	■			Temperature in the EGR extremely high	
					3	■			Input voltage of the temperature sensor high	Short to V+
					4	■			Input voltage of the temperature sensor low	Short to V-
					15	■			Temperature in the EGR high	
					16	■			Temperature in the EGR moderately high	
443	**443**								**ENGINE RUN output status**	
					3			■	Engine run output open/short to B+	
					4			■	Engine run output short to B-	
523									**Gear selection**	
					9	■			Gear selection invalid	Not possible with Genset application
608		**250**				■			**Data link faulty J1587 Start/Stop redundancy / J1939 communication bus**	
608				**132**		■			**Redundancy of the accelerator**	
608				**98**		■			**Redundancy of the Stop/start information**	
611									**Injector wiring status**	
					3	■			Injector wiring shorted to power source	
					4	■			Injector wiring shorted to ground	
620	**262**	**232**					■		**5 Volt sensor power supply**	**FMI not informed by VOLVO**
					3	■		■	Sensor power supply open/short to B+	
					4	■		■	Sensor power supply short to ground	
626			**45**				■		**Start enable device (intake heater and ether)**	
					3		■		Start enable device output short to B+	Not used, the control panel is in charge of managing the start enable device
					4		■		Start enable device output short to ground	
					5		■		Start enable device output open circuit	
627									**Power supply**	
					1	■			Injector supply voltage problem	For 6125HF070 only
					4	■			ECU unswitched power missing	For 6068HF275 VP44 only
					18	■			Battery voltage below the operating voltage	For John DEERE Tiers III
628		**240**					■		**Memory fault in EMS2**	
629		**254**					■		**ECU status/controller error**	**CIU module status**
					2		■		RAM cell test failure	
					8		■		CPU watchdog reset test failure	
					11		■		Main and fuelling ASIC test fail	
					12	■	■		RAM address test failure	
					13	■	■		Watchdog trip failure	
					19	■			ECU to injection pump communication error	Possible only with 6068HF475 VP44
630		**253**					■		**Data set memory EEPROM**	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
632									**Injection status**	
					2	■			Fuel shutoff error	
					5	■			Fuel shutoff non-functional	
636		**21**							**Pump position sensor/Cam position sensor/Speed sensor CAM**	Pump position or CAM position in function of the type of injection
					2	■	■		Pump position sensor/cam position sensor input noise	
					3		■		Permanent loss of signal	
					5	■			High impedance of the position sensor or circuit open	
					6	■			Sensor short to ground	
					8	■	■		Pump position sensor/cam position sensor input missing	
					9		■		Not informed by VOLVO	
					10	■			Pump position sensor/cam position sensor input pattern error	
637		**22**							**Crank position sensor/Speed sensor flywheel**	
					2	■	■		Crank position input noise	
					3		■		Permanent loss of signal	
					5	■			High impedance of the position sensor or open circuit	
					6	■			Sensor short to ground	
					7	■			Crank position/Cam position out of synchronisation	
					8	■	■		Crank position input missing	
					9		■		Not informed by VOLVO	
					10	■			Crank position sensor input pattern error	
639	**247**	**231**							**Communication status**	
					2		■		Bus Off error	
					9		■		Passive bus error	
					11		■		Data registers read back failure	
					12		■		Loss of message error	
					13	■			Bus CAN error	
640									**Engine shutdown vehicle status**	
					11	■			Engine shutdown vehicle request invalid	
					31	■			Engine shutdown vehicle request	
641									**Status of the Turbo with variable geometry**	
					4	■			Supply voltage of the Turbo actuator low	
					12	■			Error in communication between the ECU and the TGV actuator	
					13	■			Error in position of the TGV	
					16	■			Temperature of the actuator moderately high.	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
651	**1**	**1**	**651**				■		**Cylinder #1 injector status**	
					0	■			Injector outside specifications	Recalibration of the injectors required
					1	■			Injector outside specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #1 circuit open	
					6	■			Cylinder #1 circuit shorted	
					7	■	■	■	Cylinder #1 balancing error/mechanical failure	
					11		■	■	Cylinder #1 unknown error/mechanical failure	
652	**2**	**2**	**652**				■		**Cylinder #2 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #2 circuit open	
					6	■			Cylinder #2 circuit shorted	
					7	■	■		Cylinder #2 balancing error/mechanical failure	
					11		■		Cylinder #2 unknown error/mechanical failure	
653	**3**	**3**	**653**				■		**Cylinder #3 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #3 circuit open	
					6	■			Cylinder #3 circuit shorted	
					7	■	■	■	Cylinder #3 balancing error/mechanical failure	
					11		■	■	Cylinder #3 unknown error/mechanical failure	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
654	**4**	**4**	**654**				■		**Cylinder #4 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #4 circuit open	
					6	■			Cylinder #4 circuit shorted	
					7	■	■	■	Cylinder #4 balancing error/mechanical failure	
					11		■	■	Cylinder #4 unknown error/mechanical failure	
655	**5**	**5**	**655**				■		**Cylinder #5 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #5 circuit open	
					6	■			Cylinder #5 circuit shorted	
					7	■	■	■	Cylinder #5 balancing error/mechanical failure	
					11		■	■	Cylinder #5 unknown error/mechanical failure	
656	**6**	**6**	**656**				■		**Cylinder #6 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #6 circuit open	
					6	■			Cylinder #6 circuit shorted	
					7	■	■	■	Cylinder #6 balancing error/mechanical failure	
					11		■	■	Cylinder #6 unknown error/mechanical failure	
676		**39**							**Glow plug relay status**	
					3	■			Glow plug relay voltage high	
					5	■			Glow plug relay voltage low	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
677		**39**		**3**					**Start relay status**	
					3		■		Start relay control short circuit to high	
					4		■		Start relay control short circuit low	
					5		■		Start relay control open circuit	
678	**41**								**8 Volt power supply**	
					3			■	ACM 8 Volt DC supply open/short to B+	
					4			■	ACM 8 Volt DC supply open/short to ground	
679		**42**				■			**Regulation sensor of the injection pressure control**	
723	**342**								**Secondary speed sensor**	
					2			■	Secondary engine speed sensor data intermittent	
					11			■	Secondary engine speed sensor loss of signal	
					12			■	Loss of signal/sensor failure	
729		**70**							**Inlet air heater signal/Preheat detection**	
					3	■			Inlet air heater signal high	
					5	■			Inlet air heater signal low	
810									**Vehicle speed**	
					2	■			Calculated vehicle speed input noise	Not possible with Genset application
861	**861**								**Diagnostic output status**	
					3			■	Diagnostic output open/short to B+	
					4			■	Diagnostic output short to ground	
898									**CAN throttle status**	
					9	■			Speed value invalid or missing	
970				**6**					**Auxiliary engine shutdown switch status EMS**	
					2	■			Auxiliary engine shutdown switch signal invalid	Not used
					31	■			Auxiliary engine shutdown switch active	
971									**External engine de rate switch status**	
					31	■			External engine de rate switch active	Not used
1069									**Tire size status**	
					2	■			Tire size error	Not possible with Genset application
					9	■			Tire size invalid	
					31	■			Tire size error	
1075									**Feed pump of the fuel circuit**	
					5	■			High impedance at the terminals of the pump or open circuit	
					6	■			Pump coil short to ground	
					12	■			Pump defective	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
1076							■		**Fuel Injection pump status**	
					0	■			Pump control valve closure too long	Injection DE10
					1	■			Pump control valve closure too short	Injection DE10
					2	■			Pump detected defect	Injection VP44
					3	■			Pump solenoid current high	Injection DE10
					5	■			Pump solenoid circuit open	Injection DE10
					6	■			Pump solenoid circuit severely shorted	Injection DE10
					7	■			Pump control valve closure not detected	Injection DE10
					10	■			Pump solenoid circuit moderately shorted	Injection DE10
					13	■			Pump current decay time invalid	Injection DE10
1077									**Fuel injection pump controller status**	
					7	■			Attempting to fuel without command	
					11	■			Pump supply voltage out of range	
					12	■			Pump self test error	
					19	■			Pump detected communication error	
					31	■			Pump initiated engine protection	
1078									**ECU/Pump timing status**	
					7	■			ECU/Pump timing moderately out of synchronisation	
					11	■			ECU/Pump timing speed out of synchronisation	
					31	■			ECU/Pump timing extremely out of synchronisation	
1079		**232**							**Sensor supply voltage (+5 Volt)**	**Analog throttle reference**
					3	■			Sensor supply voltage high	> 5,5 Volt
					4	■			Sensor supply voltage low	< 4,44 Volt
1080		**211**							**Sensor supply voltage (Oil pressure, Coolant temp, fuel pressure)/+5V sensor supply 2**	
					3	■			Sensor supply voltage high	> 5,5 Volt
					4	■			Sensor supply voltage low	< 4,40 Volt
1109									**Engine/ECU status**	
					31	■			Engine shutdown warning	
1110									**Engine status**	
					31	■			Engine shutdown	
1111	**268**								**Check parameters**	
					2			■	Programmed parameter fault	
1136				**55**			■		**ECU Temperature**	
					0	■			ECU temperature extremely high	
					16	■			ECU temperature moderately high	
1172									**Input temperature of the TGV compressor**	
					3	■			Input voltage of the temperature sensor high	Short to V+
					4	■			Input voltage of the temperature sensor low	Short to V-

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
1180									**Input temperature of the TGV turbine**	
					0	■			Turbine temperature extremely high	Short to V+
					16	■			Turbine temperature moderately high	Short to V-
1184			**173**						**Exhaust gas temperature sensor**	
1239				**96**			■		**Status of the pressure system of the common rail**	
1347									**Pump control valve status**	**Pump control valve #1 status for 6081HF070**
					3	■			Pump control valve current high	
					5	■			Pump control valve error/mismatch	
					7	■			Fuel rail pressure control error	
					10	■			Pump control valve fuel flow not detected	
1348									**Pump control valve #2 status**	**Only for 6081HF070**
					5	■			Pump control valve #2 error/mismatch	
					10	■			Pump control valve #2 fuel flow not detected	
1485			**1485**	**5**					**Pump power relay status**	**ECU main relay of VOLVO EMS/EDC**
					2	■			Pump power relay fault	
					3		■			ECU main relay short circuit high
1568									**Torque curve selection**	
					2	■			Torque curve selection invalid	
					4	■			Torque curve input voltage high	
					9	■			Torque curve selection missing	
1569									**Fuel supply status**	
					31	■			Fuel de rate	
1639									**Fan speed sensor**	
					1	■			Fan speed signal missing	Not possible with Genset application
					2	■			Fan speed signal erratic	
					16	■			Fan speed higher than expected	
					18	■			Fan speed lower than expected	
2000									**ECU status**	
					6	■			Vehicle ID missing	
					13	■			Security violation	
2630									**Air temperature at the air cooler outlet**	
					0	■			Air temperature extremely high	
					3	■			Sensor input voltage high	Short to V+
					4	■			Sensor input voltage low	Short to V-
					15	■			Air temperature high	
					16	■			Air temperature moderately high	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
2659									**Flow level of the EGR valve**	
					2	■			Calculated EGR flow not valid	
					15	■			Calculated EGR flow rather high	
					17	■			Calculated EGR flow rather low	
2790									**Air temperature at turbo compressor outlet**	
					16	■			Temperature at compressor outlet moderately high	
2791				**19**			■		**Statuses of the EGR valve**	
					2	■			Valve position signal not valid	
					3	■			Input voltage of the position sensor high	Short to V+
					4	■			Input voltage of the position sensor low	Short to V-
					7	■			Inability of the EGR valve to reach the expected position	
					13	■			The EGR valve is out of calibration	
					31	■			Error in position of the EGR valve	
2795									**Position of TGV actuator**	
					7	■			The actuator does not respond or is not in the expected position	
3509									**Common supply voltage of the sensors, output #1**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
3510									**Common supply voltage of the sensors, output #2**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
3511									**Common supply voltage of the sensors, output #3**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
3512									**Common supply voltage of the sensors, output #4**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
3513									**Common supply voltage of the sensors, output #5**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
520192				**8**			■		**Cooling status of the piston**	
520194				**4**			■		**Status of the starting request input**	
520195				**6**			■		**Stop request on CIU**	

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FMI and Description

FMI=0—DATA VALID BUT ABOVE NORMAL OPERATIONAL RANGE - MOST SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined most severe level limits for that particular measure of the real world condition (*Region e* of the signal range definition) Broadcast of data values is continued as normal. Broadcast of data values is continued as normal.

FMI=1—DATA VALID BUT BELOW NORMAL OPERATIONAL RANGE - MOST SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region e* of the signal range definition). Broadcast of data values is continued as normal.

FMI=2—DATA ERRATIC, INTERMITTENT OR INCORRECT
Erratic or intermittent data includes all measurements that change at a rate that is not considered possible in the real world condition and must be caused by improper operation of the measuring device or its connection to the module. Broadcast of data value is substituted with the “error indicator” value.
Incorrect data includes any data not received and any data that is exclusive of the situations covered by FMIs 3, 4, 5 and 6. Data may also be considered incorrect if it is inconsistent with other information collected or known about the system.

FMI=3—VOLTAGE ABOVE NORMAL, OR SHORTED TO HIGH SOURCE
a. A voltage signal, data or otherwise, is above the predefined limits that bound the range (*Region e* of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
b. Any signal external to an electronic control module whose voltage remains at a high level when the ECM commands it to low. Broadcast of data value is substituted with the “error indicator” value.

FMI=4—VOLTAGE BELOW NORMAL, OR SHORTED TO LOW SOURCE
a. A voltage signal, data or otherwise, is below the predefined limits that bound the range (Region e of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
b. Any signal external to an electronic control module whose voltage remains at a low level when the ECM commands it to high. Broadcast of data value is substituted with the “error indicator” value.

FMI=5—CURRENT BELOW NORMAL OR OPEN CIRCUIT
a. A current signal, data or otherwise, is below the predefined limits that bound the range (Region e of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
b. Any signal external to an electronic control module whose current remains off when the ECM commands it on. Broadcast of data value is substituted with the “error indicator” value.

FMI=6—CURRENT ABOVE NORMAL OR GROUNDED CIRCUIT
a. A current signal, data or otherwise, is above the predefined limits that bound the range. (*Region e* of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
b. Any signal external to an electronic control module whose current remains on when the ECM commands it off. Broadcast of data value is substituted with the “error indicator” value.

FMI=7—MECHANICAL SYSTEM NOT RESPONDING OR OUT OF ADJUSTMENT
Any fault that is detected as the result of an improper mechanical adjustment or an improper response or action of a mechanical system that, with a reasonable confidence level, is not caused by an electronic or electrical system failure. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=8—ABNORMAL FREQUENCY OR PULSE WIDTH OR PERIOD
To be considered in cases of FMI 4 and 5. Any frequency or PWM signal that is outside the predefined limits which bound the signal range for frequency or duty cycle (outside *Region b* or the signal definition). Also if the signal is an ECM output, any signal whose frequency or duty cycle is not consistent with the signal which is emitted. Broadcast of data value is substituted with the “error indicator” value.

FMI=9—ABNORMAL UPDATE RATE
Any failure that is detected when receipt of data via the data link or as input from a smart actuator or smart sensor is not at the update rate expected or required by the ECM (outside *Region c* of the signal range definition). Also any error that causes the ECM not to send information at the rate required by the system. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=10—ABNORMAL RATE OF CHANGE
Any data, exclusive of the abnormalities covered by FMI 2, that is considered valid but whose data is changing at a rate that is outside the predefined limits that bound the rate of change for a properly functioning system (outside *Region c* of the signal range definition). Broadcast of data values is continued as normal.

FMI=11—ROOT CAUSE NOT KNOWN
It has been detected that a failure has occurred in a particular subsystem but the exact nature of the fault is not known. Broadcast of data value is substituted with the "error indicator" value.

FMI=12—BAD INTELLIGENT DEVICE OR COMPONENT
Internal diagnostic procedures have determined that the failure is one which requires the replacement of the ECU, used here to mean the packaged unit that includes some microprocessor and its associated components and circuits. It can be assumed that the communications subsystem is not the part that has failed, and the manufacturer has determined that there is no serviceable component smaller than the ECU involved in the failure. Broadcast of data value is substituted with the "error indicator" value if appropriate, as there may or may not be any broadcast involved. This error is to include all internal controller trouble codes that can not be caused by connections or systems external to the controller.

FMI=13—OUT OF CALIBRATION
A failure that can be identified to be the result of not being properly calibrated. This may be the case for a subsystem which can identify that the calibration attempting to be used by the controller is out of date. Or it may be the case that the mechanical subsystem is determined to be out of calibration. This failure mode does not relate to the signal range definition as do many of the FMIs.

FMI=14—SPECIAL INSTRUCTIONS
"Special Instructions" is the FMI to be used when the on-board system can isolate the failure to a small number of choices but not to a single point of failure. When the FMI is used, there is clear necessity for the service technician to take some action to complete the specific diagnosis, and the manufacturer has provided instructions for the completion of that diagnosis. There are two cases where this will be used: 1. for emission-related diagnostics where the particular failure cannot be separated between a sensor out of range and the case where the actual value is at the edge of a diagnostic region, and 2. for the older SPN 611 to 615 where the problem is in determining which of two or more circuits (which may interact) is the one that needs repair.
SPNs 611 through 615 are defined as "System Diagnostic Codes" and are used to identify failures that cannot be tied to a specific field replaceable component. Specific subsystem fault isolation is the goal of any diagnostic system, but for various reasons this cannot always be accomplished. These SPNs allow the manufacturer some flexibility to communicate non-"specific component" diagnostic information. Since SPNs 611-615 use the standard SPN/FMI format it allows the use of standard diagnostic tools, electronic dashboards, satellite systems and other advanced devices that scan Parameter Groups containing the SPN/FMI formats. Because manufacturer defined codes are not desirable in terms of standardization, the use of these codes should only occur when diagnostic information cannot be communicated as a specific component and failure mode.
Possible reasons for using a System Diagnostic Code include:

1. Cost of specific component fault isolation is not justified, or
2. New concepts in Total Vehicle Diagnostics are being developed, or
3. New diagnostic strategies that are not component specific are being developed.

Due to the fact that SPNs 611-615 are manufacturer defined and are not component specific, FMIs 0-13 and 15-31 have little meaning. Therefore, FMI 14, "Special Instructions", is usually used. The goal is to refer the service personnel to the manufacturer's troubleshooting manual for more information on the particular diagnostic code. This failure mode does not relate to the signal range definition as do many of the FMIs. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=15—DATA VALID BUT ABOVE NORMAL OPERATING RANGE - LEAST SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region i* of the signal range definition). Broadcast of data values is continued as normal.

FMI=16—DATA VALID BUT ABOVE NORMAL OPERATING RANGE - MODERATELY SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (*Region k* of the signal range definition). Broadcast of data values is continued as normal.

FMI=17—DATA VALID BUT BELOW NORMAL OPERATING RANGE - LEAST SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region h* of the signal range definition). Broadcast of data values is continued as normal.

FMI=18—DATA VALID BUT BELOW NORMAL OPERATING RANGE - MODERATELY SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (*Region j* of the signal range definition). Broadcast of data values is continued as normal.

FMI=19—RECEIVED NETWORK DATA IN ERROR
Any failure that is detected when the data received via the network is found substituted with the “error indicator” value (i.e. FE16, see J1939-71). This type of failure is associated with received network data. The component used to measure the real world signal is wired directly to the module sourcing the data to the network and not to the module receiving the data via the network. The FMI is applicable to *Region f* and *g* of the signal range definition. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=20-30—RESERVED FOR SAE ASSIGNMENT

FMI=31—CONDITION EXISTS
Used to indicate that the condition that is identified by the SPN exists when no more applicable FMI exists or in cases when the reported SPN name spells out the component and a non-standard failure mode. This type of fault may or may be directly associated with the value of general broadcast information. This FMI will mean “not available” when the associated SPN is also “not available” as when the remainder of the packet is filled with binary ones after all data has been transmitted.